



Main Group and Primary Site of Action	Chemical Sub-group or Exemplifying Active Ingredient	Cotton Insecticides and Miticides Active Ingredients (Trade Names ®)
1 Acetylcholine esterase inhibitors	1A Carbamates  Triazamate	Aldicarb (Temik) Carbaryl (Sevin) Methomyl (Lannate) Oxamyl (Vydate) Thiodicarb (Larvin)
	1B Organophosphates	Acephate (Address, Orthene, Payload) Azinphos-methyl (Guthion) Chlorpyrifos (Lorsban) Dicrotophos (Bidrin) Dimethoate (Dimate, Dimethoate) Disulfoton (Di-Syston) Malathion (Fyfanon, Malathion) Methamidophos (Monitor) Methidathion (Supracide) Oxydemeton-methyl (Metasytox-R) Parathion (Parathion) Parathion-methyl (Methyl Parathion, Penncap-M) Phorate (Thimet) Profenofos (Curacron)
2 GABA-gated chloride channel antagonists	2A Cyclodiene organochlorines	Endosulfan (Thionex)
	2B Phenylpyrazoles (Fiproles)	
3 Sodium channel modulators	DDT  Methoxychlor    Pyrethroids    Pyrethrins	Bifenthrin (Capture, Discipline, Double Threat CP *) Cyfluthrin (Baythroid, Leverage **) gamma-cyhalothrin (Proaxis, Prolex) lambda-cyhalothrin (Karate Z, Silencer) Cypermethrin (Ammo, Battery, UP-Cyde) zeta-cypermethrin or zetamethrin (Fury, Mustang Max) Deltamethrin (Decis) Esfenvalerate (Asana XL) Fenpropathrin (Danitol) Permethrin (Permethrin) Tralomethrin (Scout X-tra)

\* Double Threat CP is bifenthrin + spinosad

\*\* Leverage is cyfluthrin + imidacloprid



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4 Nicotinic Acetylcholine receptor agonists / antagonists	4A Neonicotinoids	Acetamiprid (Assail, Intruder) Dinotefuran (Venom) Imidacloprid (Admire, Couraze, Gaucho, Leverage**, Provado, Trimax) Thiamethoxam (Centric, Cruiser)
	4B Nicotine	
	4C Bensultap Cartap hydrochloride Nereistoxin analogues	
5 Nicotinic Acetylcholine receptor agonists (allosteric) (not grp 4)	Spinosyns	Spinosad (Double Threat CP*, Entrust, Success (California only), Tracer)
6 Chloride channel activators	Avermectins, Milbemycins	Abamectin (ABBA, Zephyr) Emamectin benzoate (Denim)
7 Juvenile hormone mimics	7A Juvenile hormone analogues	
	7B Fenoxycarb	
	7C Pyriproxyfen	Pyriproxyfen (Knack)
8 Compounds of unknown or non-specific mode of action (fumigants)	8A Alkyl halides	
	8B Chloropicrin	Chloropicrin (Telone)
	8C Sulfuryl fluoride	
9 Compounds of unknown or non-specific mode of action (selective feeding blockers)	9A Cryolite	
	9B Pymetrozine	Pymetrozine (Fulfill)
	9C Flonicamid	Flonicamid (Carbine)
10 Compounds of unknown or non-specific mode of action (mite growth inhibitors)	10A Clofentezine Hexythiazox	Hexythiazox (Onager (California only))
	10B Etoxazole	Etoxazole (Zeal)
11 Microbial disruptors of insect midgut membranes (includes transgenic crops expressing <i>Bacillus thuringiensis</i> toxins)	11A1 <i>B.t.</i> subsp. <i>israelensis</i>	
	11A2 <i>B. sphaericus</i>	
	11B1 <i>B.t.</i> subsp. <i>aizawai</i>	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i> (Agree, WideStrike, XenTari)
	11B2 <i>B.t.</i> subsp. <i>kurstaki</i>	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> (Bollgard, Bollgard II, Condor, Deliver, DiPel, Javelin, WideStrike)
	11C <i>B.t.</i> subsp. <i>tenebrionis</i>	



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12 Inhibitors of oxidative phosphorylation, disruptors of ATP formation (inhibitors of ATP synthase)	12A Diafenthiuron	
	12B Organotin miticides	
	12C Propargite Tetradifon	Propargite (Comite)
13 Uncouplers of oxidative phosphorylation via disruption of proton gradient	Chlorfenapyr  DNOC	
14 vacant		
15 Inhibitors of chitin biosynthesis, type 0, Lepidopteran	Benzoylureas	Diflubenzuron (Dimilin) Novaluron (Diamond)
16 Inhibitors of chitin biosynthesis, type 1, Homopteran	Buprofezin	Buprofezin (Courier)
17 Moulting disruptor, Dipteran	Cyromazine	
18 Ecdysone agonists / moulting disruptors	18A Diacylhydrazines	Methoxyfenozide (Intrepid) Tebufenozide (Confirm)
	18B Azadirachtin	Azadirachtin (Neemix)
19 Octopaminergic agonists	Amitraz	Amitraz (Ovasyn)
20 Mitochondrial complex III electron transport inhibitors (Coupling site II)	20A Hydramethylnon	
	20B Acequinocyl	
	20C Fluacrypyrim	
21 Mitochondrial complex I electron transport inhibitors	METI acaricides  Rotenone	
22 Voltage-dependent sodium channel blockers	Indoxacarb	Indoxacarb (Steward)
23 Inhibitors of lipid synthesis	Tetronic acid derivatives	Spiromesifen (Oberon)



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24 Mitochondrial complex IV electron transport inhibitors	24A Aluminium phosphide	
	24B Cyanide	
	24C Phosphine	
25 Neuronal inhibitors (unknown mode of action)	Bifenazate	
26 Aconitase inhibitors	Fluoroacetate	
27 Synergists	27A P450-dependent monooxygenase inhibitors	Piperonyl butoxide
	27B Esterase inhibitors	Tribufos (DEF)
28 Ryanodine receptor modulator	Flubendiamide	
un Compounds with unknown mode of action <sup>2</sup>	una Benzoximate	
	unb Chinomethionat	
	unc Dicofol	Dicofol (Kelthane)
	und Pyridalyl	
ns Miscellaneous non-specific (multi-site) inhibitors <sup>3</sup>	nsa Borax	
	nsb Tartar emetic	

Notes to be read in association with the above classification:

<sup>1</sup> Inclusion of a compound in the list above does not necessarily signify regulatory approval

<sup>2</sup> A compound with an unknown mode of action or an unknown mode of toxicity will be held in category 'un' until evidence becomes available to enable that compound to be assigned to a more appropriate mode of action class

<sup>3</sup> Category 'ns' is used for compounds or preparations with a non-specific, multisite action.

Groups and Sub-groups – Although sharing the same primary target site, it is possible that not all members of a single major MoA class have been shown to be cross-resistant. Different resistance mechanisms that are not linked to the target site of action, such as enhanced metabolism, may be common for such a group of chemicals. In such cases, the MoA grouping is further divided into sub-groups. For the purposes of this classification it should be assumed that cross-resistance exists between compounds in any one MoA sub-class. Alternation of compounds from different sub-groups within a class may be an acceptable part of an IRM strategy. Consult a local resistance expert for further advice.

Products containing multiple or stacked toxins will be differentiated from those containing single toxins only. This will be done by adding a suffix of "m" for multiple toxin products and "s" for single toxin products. Products containing spores will be differentiated from those without spores by adding "+" for spore-containing products and "-" for those which do not contain spores. For example, *Bacillus thuringiensis* subsp. *kurstaki* products containing multiple toxins and spores may be designated as 11Dm+, while the same product without spores and expressing only one toxin would be designated as Group 11Ds-.