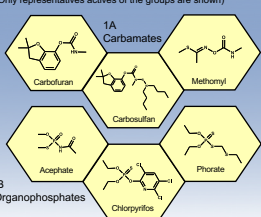
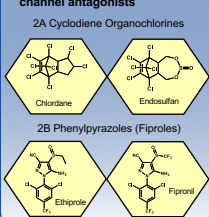


- Key to Targeted Physiology**
- Nerve & Muscle
 - Growth & Development
 - Respiration
 - Midgut
 - Protein Suppressor
 - Unknown or Non-specific

Group 1: Acetylcholinesterase (AChE) inhibitors
(Only representative actives of the groups are shown)



Group 2: GABA-gated chloride channel antagonists

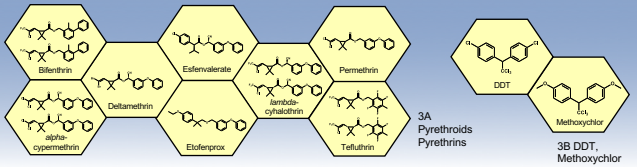


IRAC

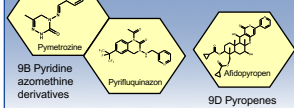
Insecticide Resistance Action Committee

Mode of Action Classification

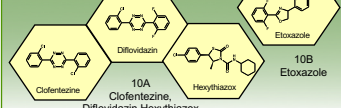
Group 3: Sodium channel modulators (Only representative actives of group 3A are shown)



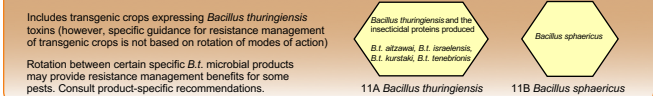
Group 9: Chordotonal organ TRPV channel modulators



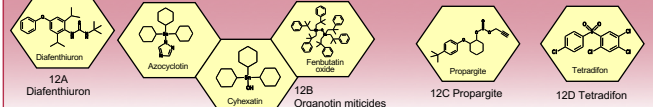
Group 10: Mite growth inhibitors affecting CHS1



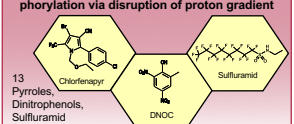
Group 11: Microbial disruptors of insect midgut membranes



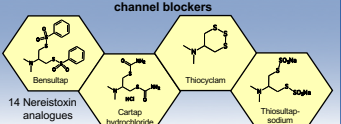
Group 12: Inhibitors of mitochondrial ATP synthase



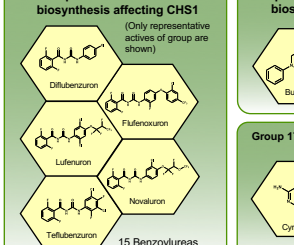
Group 13: Uncouplers of oxidative phosphorylation via disruption of proton gradient



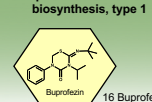
Group 14: Nicotinic acetylcholine receptor (nAChR) channel blockers



Group 15: Inhibitors of chitin biosynthesis affecting CHS1
(Only representative actives of group are shown)



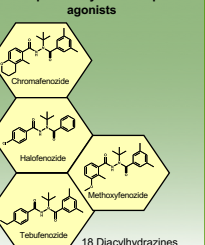
Group 16: Inhibitors of chitin biosynthesis, type 1



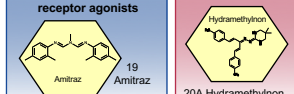
Group 17: Moulting disruptors, Diterpan



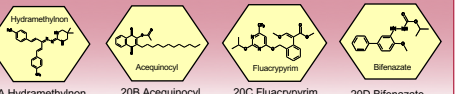
Group 18: Ecdysone receptor agonists



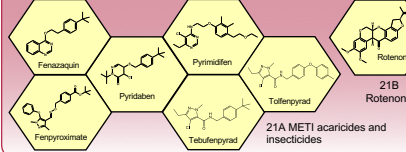
Group 19: Octopamine receptor agonists



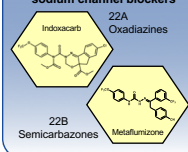
Group 20: Mitochondrial complex III electron transport inhibitors – Qo site



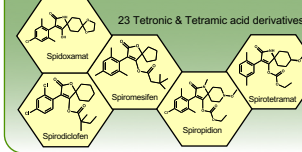
Group 21: Mitochondrial complex I electron transport inhibitors



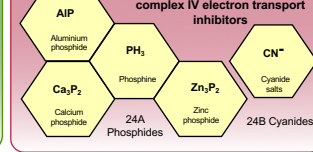
Group 22: Voltage-dependent sodium channel blockers



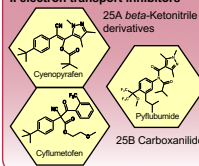
Group 23: Inhibitors of acetyl-CoA carboxylase



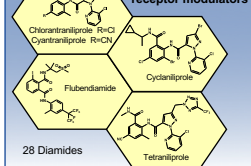
Group 24: Mitochondrial complex IV electron transport inhibitors



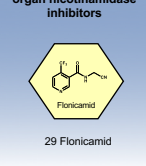
Group 25: Mitochondrial complex II electron transport inhibitors



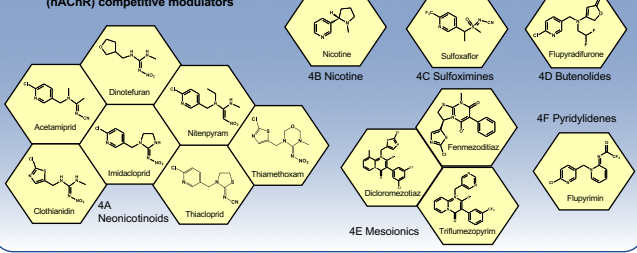
Group 28: Ryanodine receptor modulators



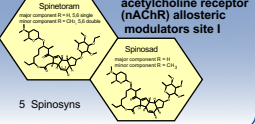
Group 29: Chordotonal organ nicotinamide inhibitors



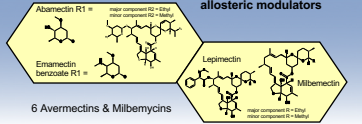
Group 4: Nicotinic acetylcholine receptor (nAChR) competitive modulators



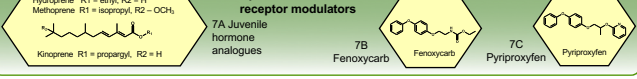
Group 5: Nicotinic acetylcholine receptor (nAChR) allosteric modulators site I



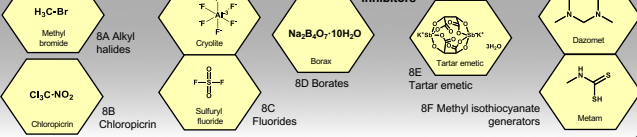
Group 6: Glutamate-gated chloride channel (GluCl) allosteric modulators



Group 7: Juvenile hormone receptor modulators



Group 8: Miscellaneous non-specific (multi-site) inhibitors



Use of Sub-Groups:

- Alternations, sequences or rotations of compounds between MoA groups reduce selection for target site resistance.
- Applications are arranged into MoA spray windows defined by crop growth stage and pest biology. Several sprays of a compound may be possible within each spray window, but successive generations of a pest should not be treated with compounds from the same MoA group. Local expert advice on spray windows and timings should always be followed.
- Groups in the classification whose members do not act at a common target site are exempt from the prescription against rotation within the group (Group 8, 13 and all UN groups: UN, UNB, UNE, UNF, UNM, UNP & UNV).

Use of Sub-Groups:

- Sub-groups represent distinct structural classes which are believed to have the same mode of action.
- Sub-groups provide differentiation between compounds that may bind at the same target site but are structurally different enough that risk of metabolic cross-resistance is lower than for close chemical analogs.
- Cross-resistance potential between sub-groups is higher than between groups, so rotation between sub-groups should be considered only when there are no alternatives, and only if cross-resistance does not exist, following consultation with local expert advice. These exceptions are not sustainable, and alternative options should be sought.

Disclaimer: While CropLife International and IRAC make every effort to present accurate and reliable information, they do not guarantee the accuracy, completeness, efficacy, timeliness, or correct sequencing of such information. Inclusion of active ingredients on the IRAC Code Lists is based on scientific evaluation of their modes of action; it does not provide any kind of testimonial for the use of a product or a judgment on efficacy. CropLife International and IRAC are not responsible for, and expressly disclaim all liability for, damages of any kind arising out of use, reference to, or reliance on information provided. Listing of chemical classes or modes of action must not be interpreted as approval for use of a compound in a given country. Prior to implementation, each user must determine the current registration status in the country of use and strictly adhere to the uses and instructions approved in that country.

Poster Notes:

- Sub-group 3B: DDT is no longer used in agriculture and therefore this is only applicable for the control of insect vectors of human disease, such as mosquitoes, because of a lack of alternatives.
- Sub-group 10A: Hexythiazox is grouped with Clofentezine because they exhibit cross-resistance even though they are structurally distinct. Diflovidazin has been added to this group because it is a close analogue of Clofentezine and is expected to have the same mode of action.
- Group 20: While there is strong evidence that Bifenazate acts on the Qo site of Mitochondrial Complex III and some Bifenazate resistance mutations confer cross-resistance to Acequinocyl, the sites of action of Fluacrypyrim and Hydramethylnon have not been determined.
- Groups 26 & 27 are unassigned.
- In some cases, only representative actives are shown.
- Because of documented cross-resistance between Dicofof, Bromopropylate and Abamectin, these active ingredients should not be rotated after each other in an IRM program.

