Registration process for new chemicals & opportunities for the mango industry

syngenta®

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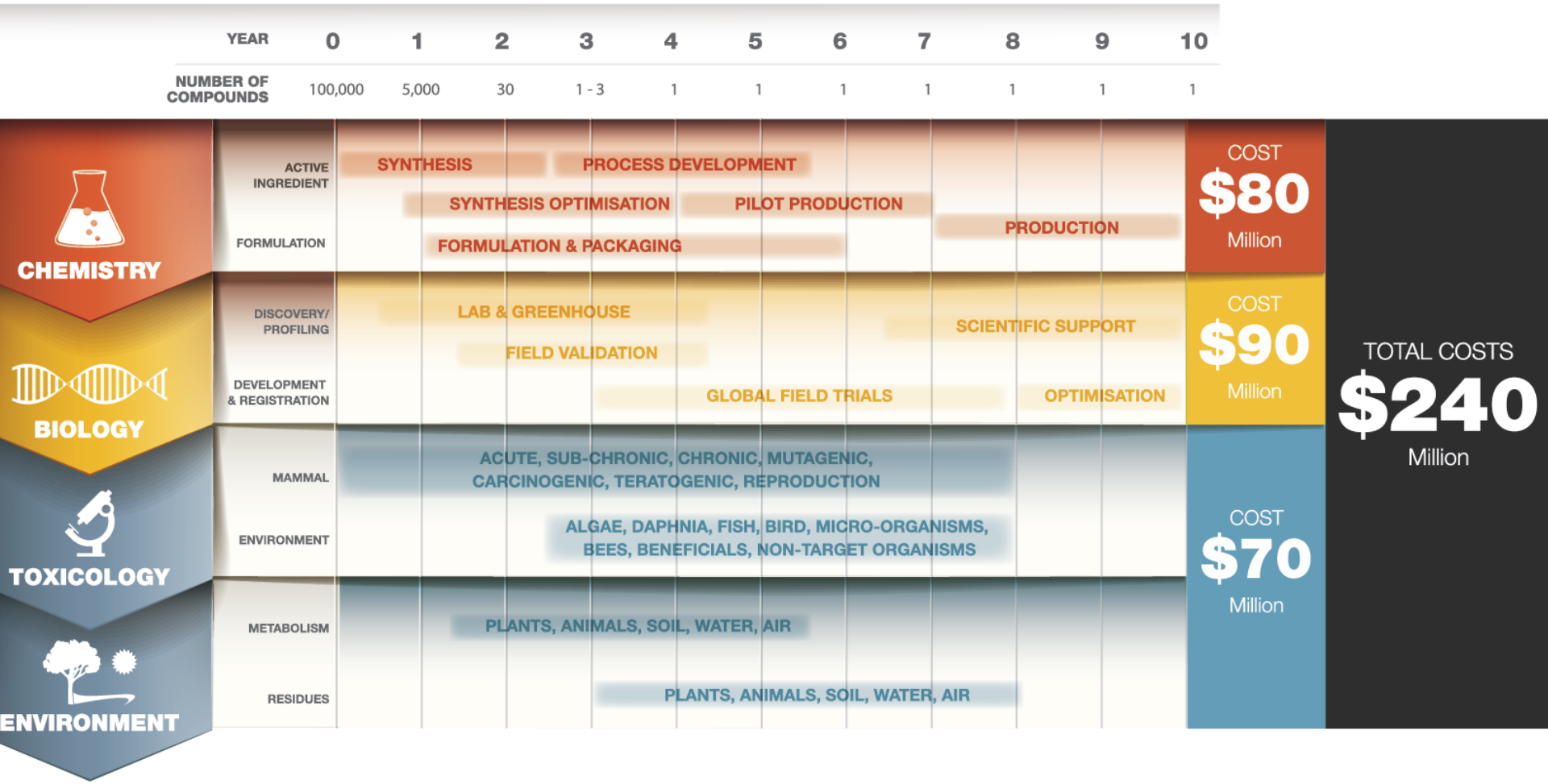
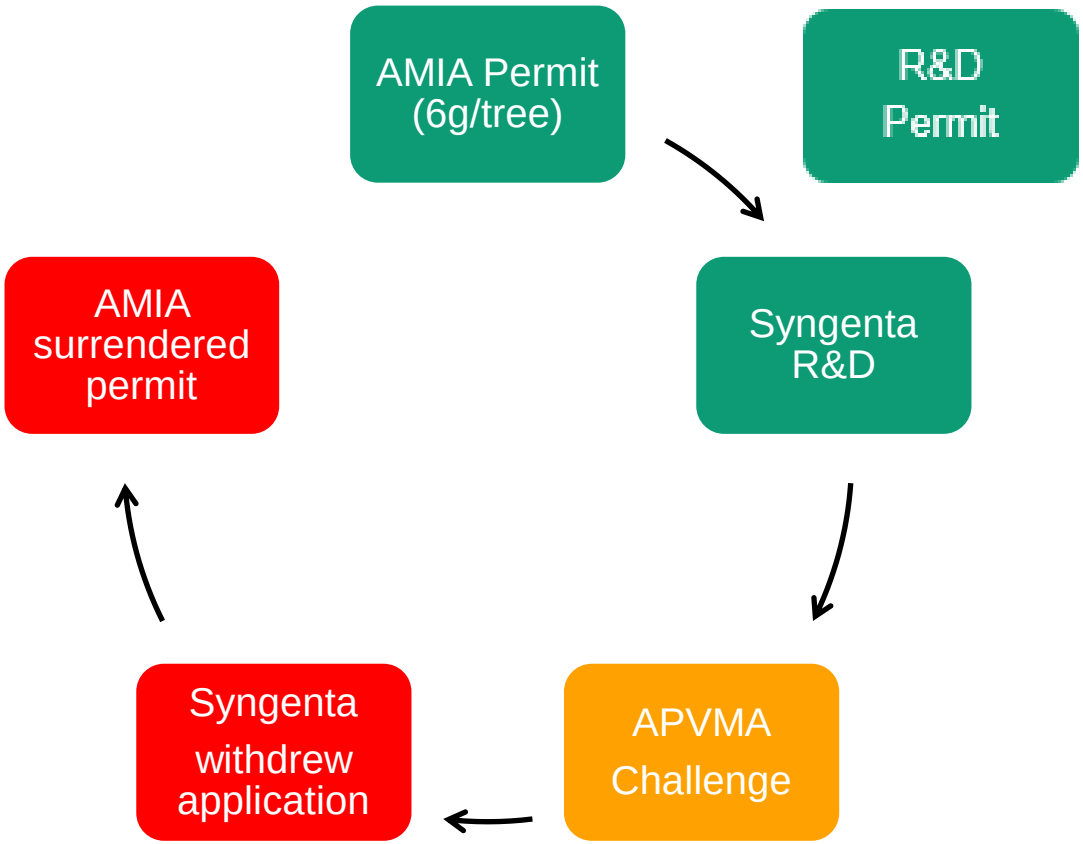
Long path from molecule to product…



Actara®

GROUP 4A



Mango seed weevil

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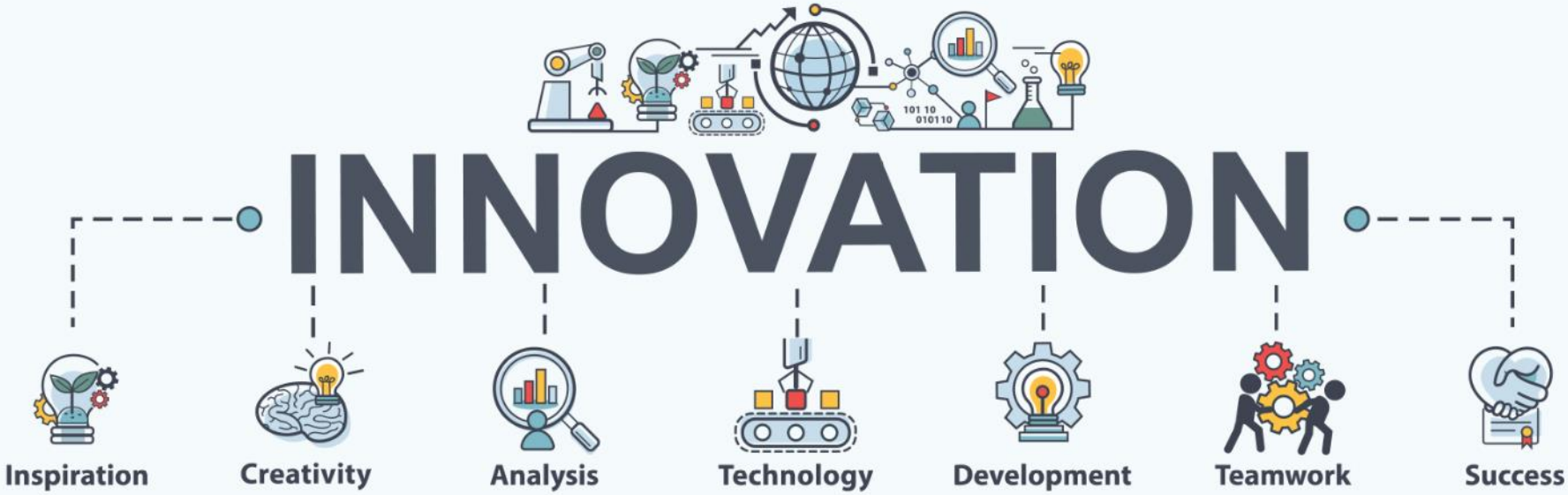
Bringing plant potential to life



Miravis®

Pydiflumetofen (7)

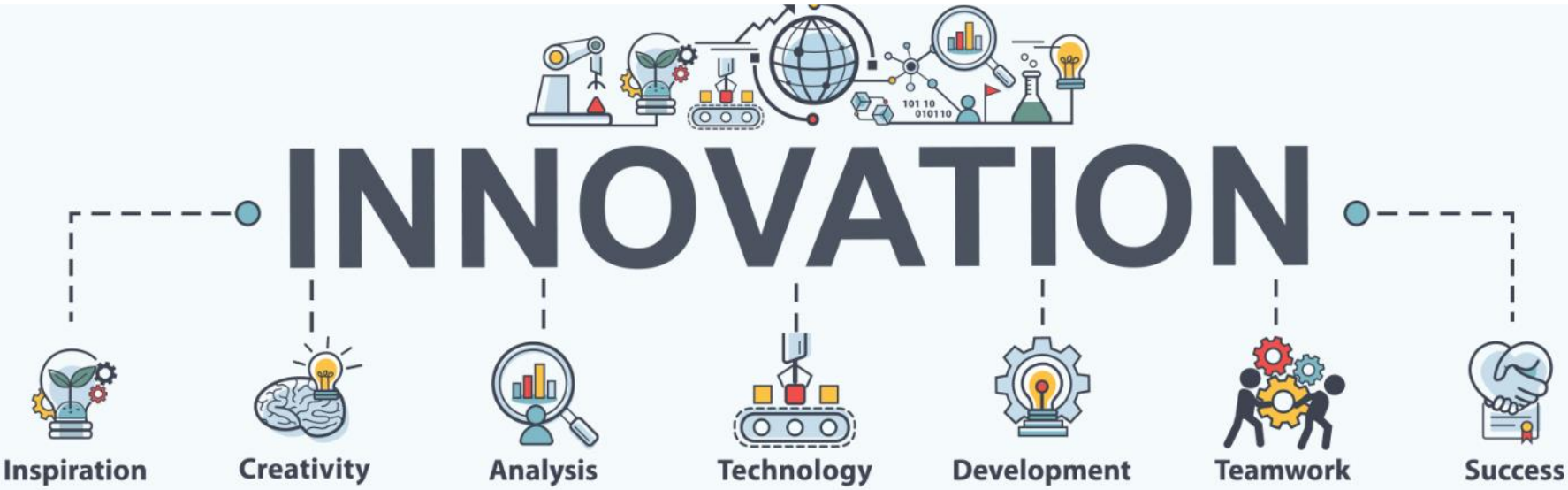
GraduateA+®

Azoxystrobin (11)
Fludioxonil (12)

Proclaim® Opti

Emamectin (6)

NEW ACTIVES	CO-FORMULATIONS	FORMULATION EXTENSIONS	LABEL EXTENSIONS



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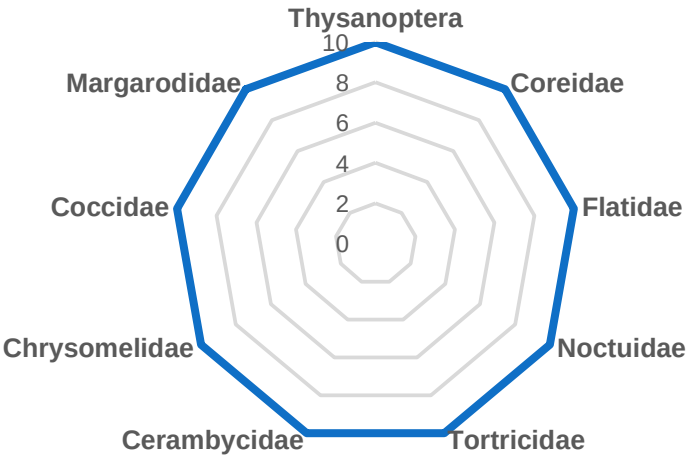
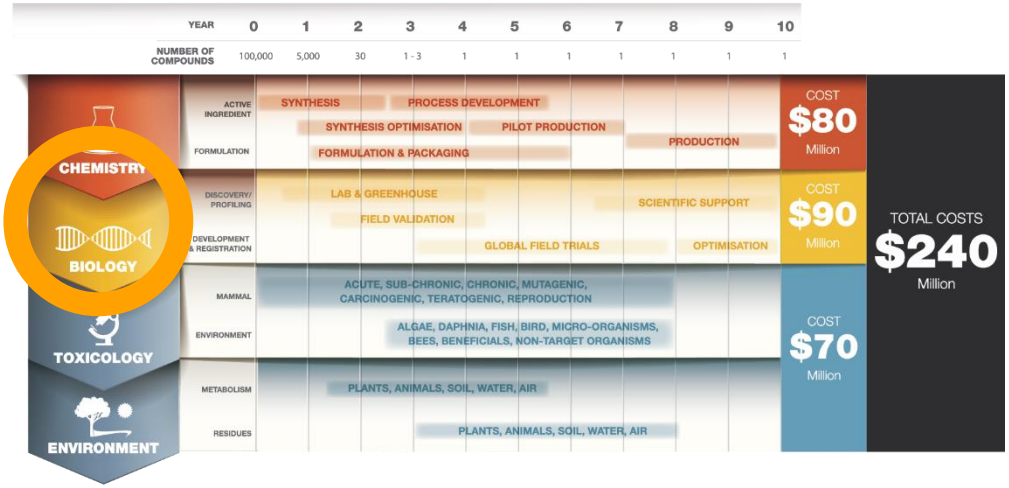
Insecticide case study

Global R&D Results

Hypothetical



10 = 100% control



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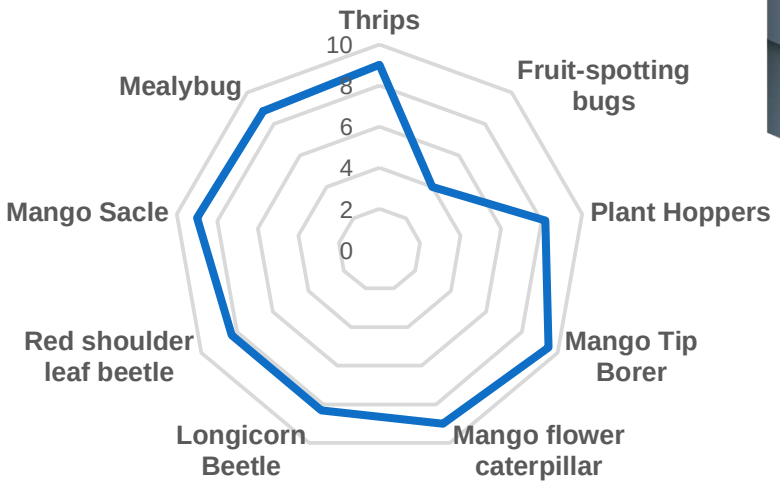
Global R&D Results

Hypothetical

Broad spectrum



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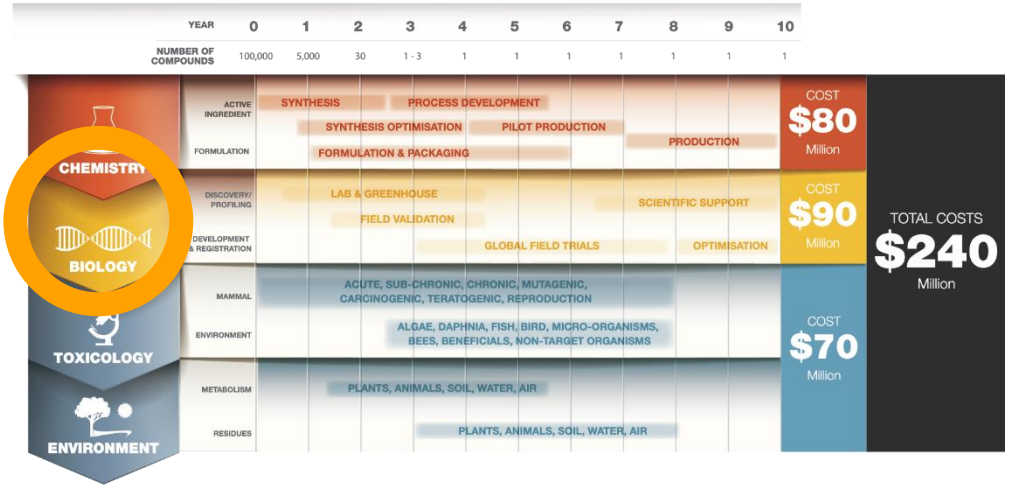

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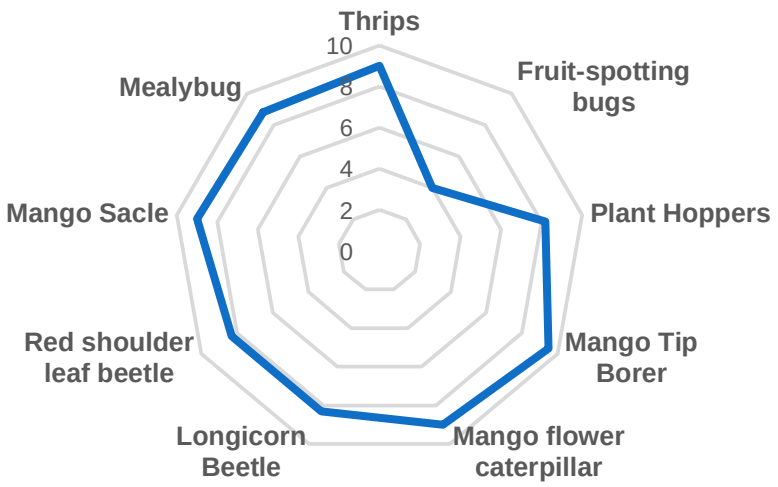
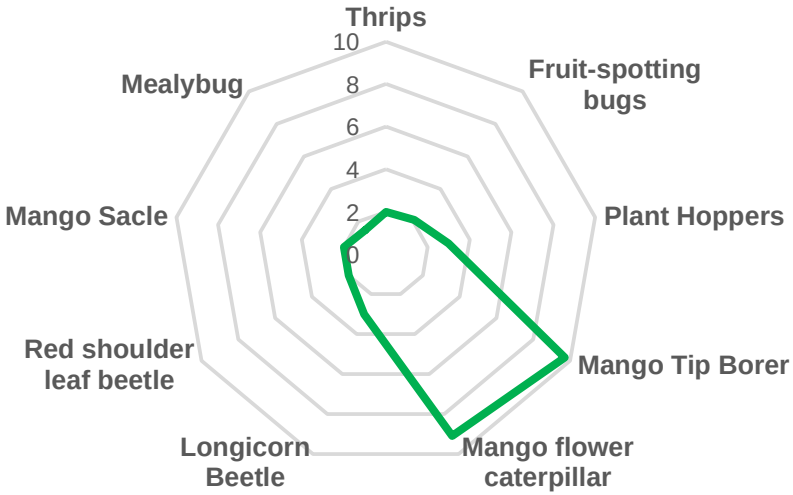


Selective



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How insecticides work

Contact

Translaminar

Systemic

How insecticides work

Contact

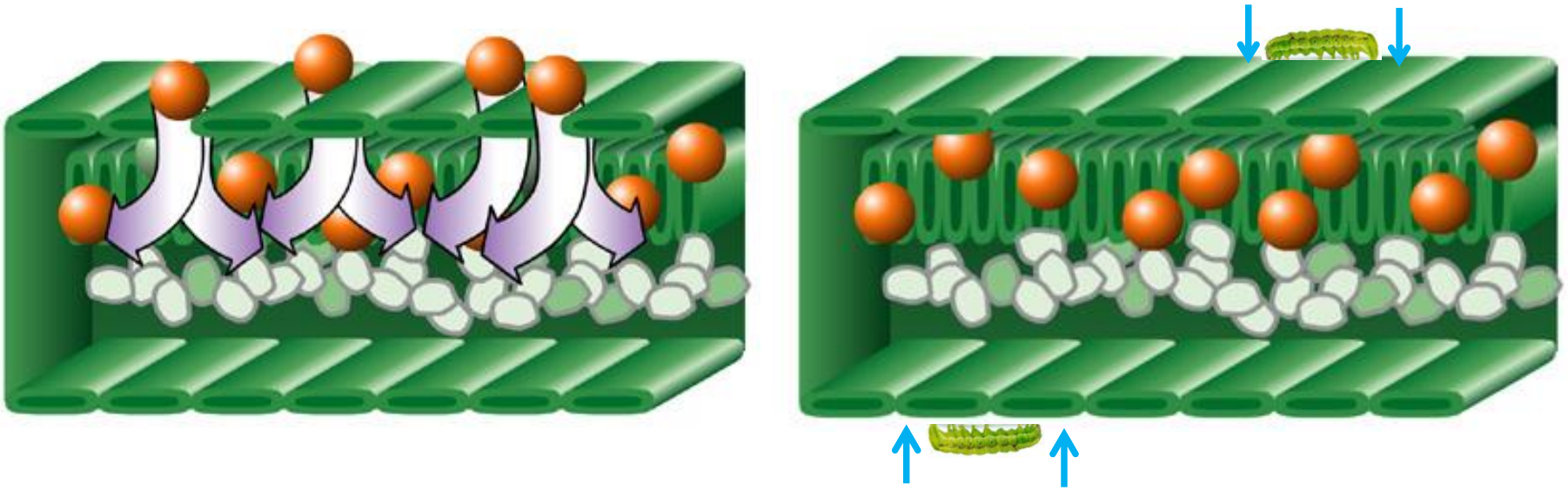
Translaminar

Systemic

- Direct contact
  - Spray
- Indirect contact
  - Residues
  - Better on mobile pests

How insecticides work

Contact **Translaminar** Systemic

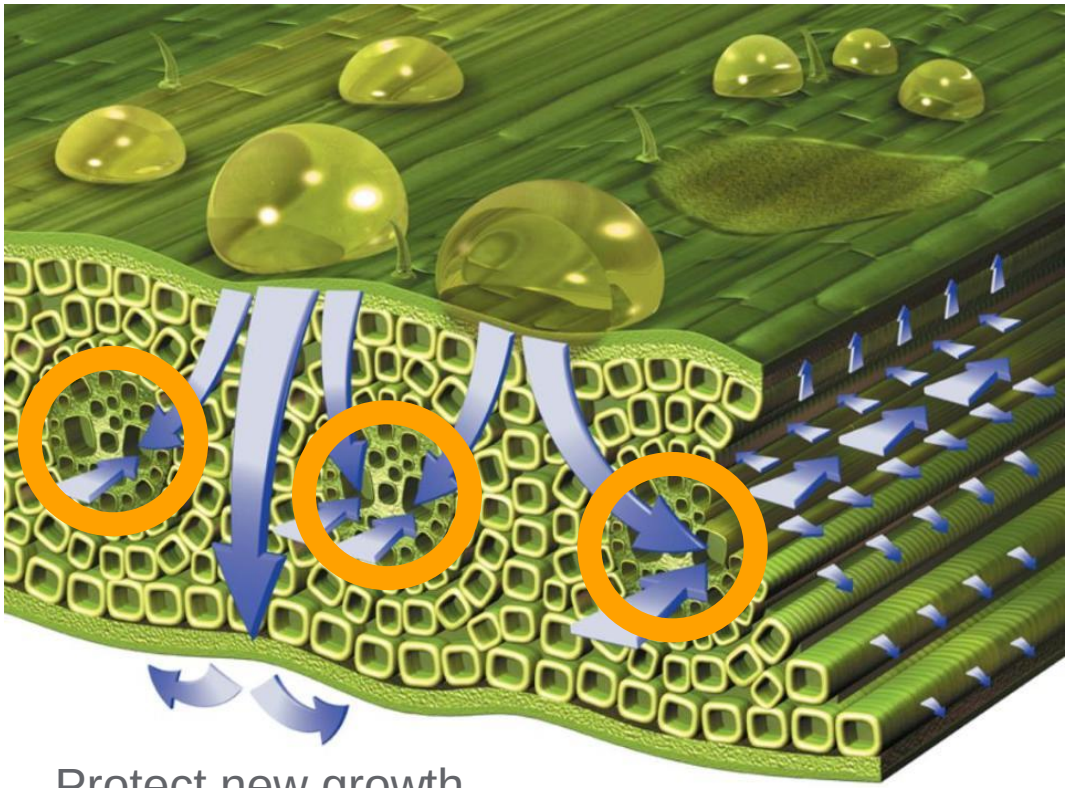


Good on hidden pests

How insecticides work

Contact Translaminar **Systemic**

Vascular bundle



Protect new growth

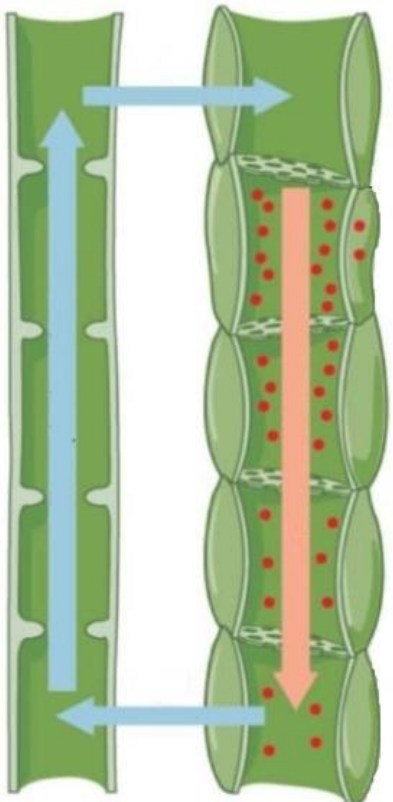
How insecticides work

Contact

Translaminar

Systemic

Systemic insecticides ‘hitch’ a ride in the xylem

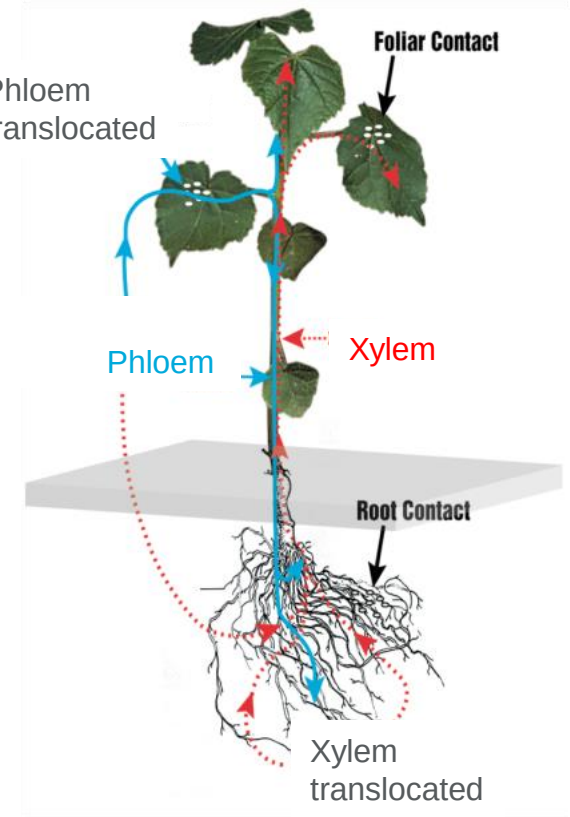


xylem

water

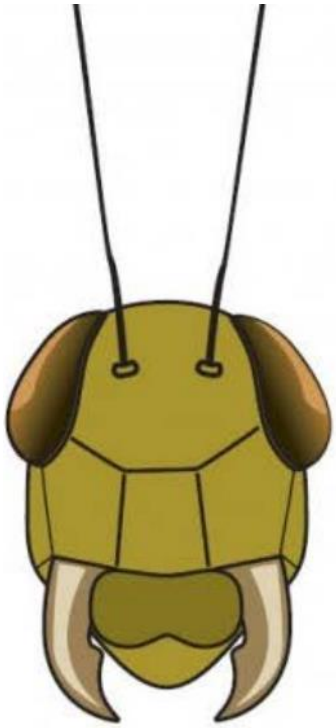
sugar

phloem

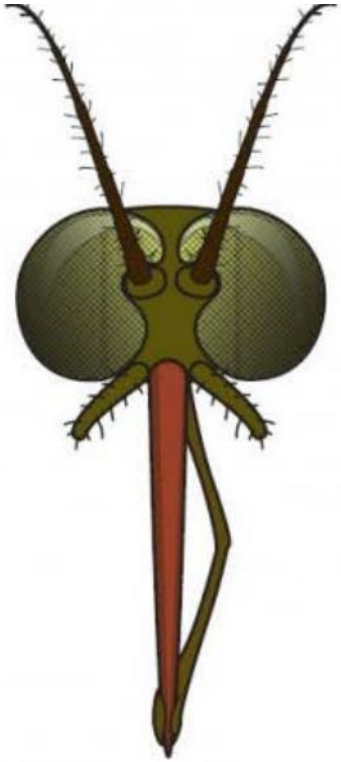


Need to understand how insects feed so you can control them

Insect feeding behaviour

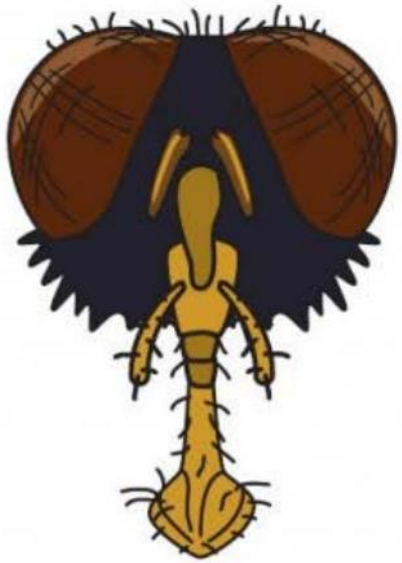


Chewing



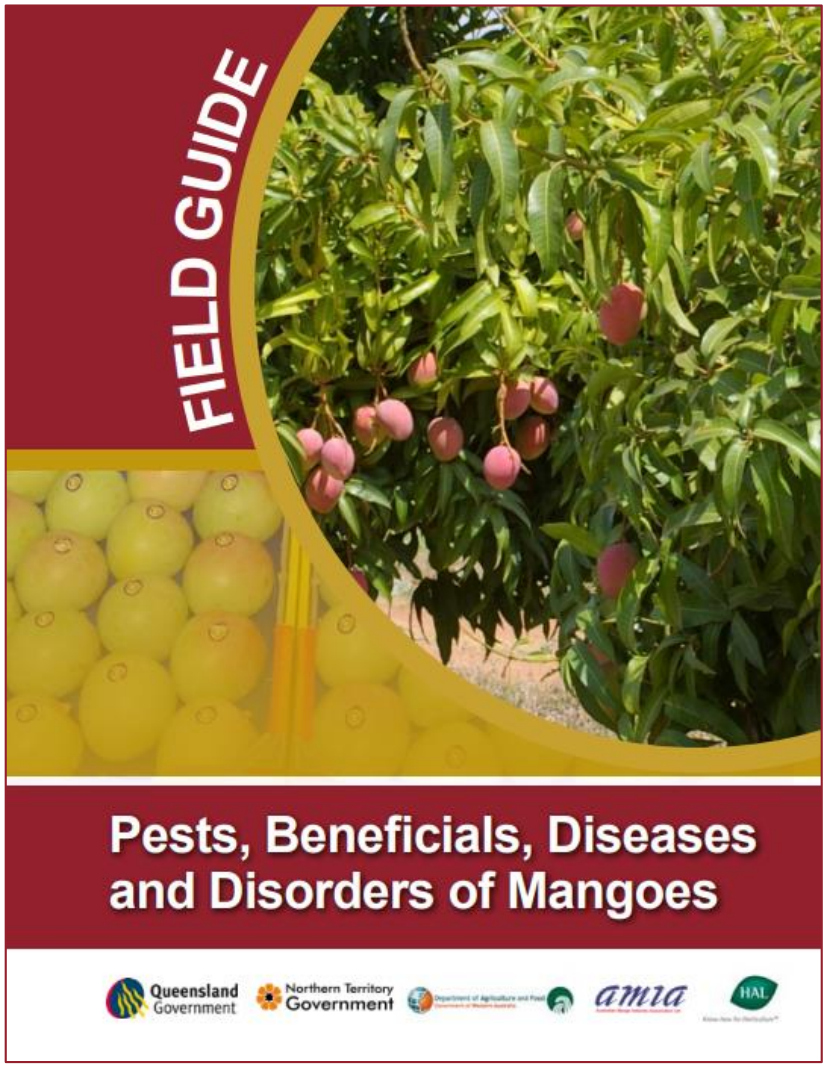
Piercing-sucking

Siphoning



Sponging

https://friendsofbalcones.org


FIELD GUIDE
Pests, Beneficials, Diseases and Disorders of Mangoes
Queensland Government
Northern Territory Government
amia
HAL

syngenta

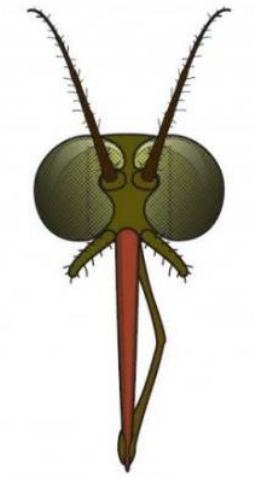
Fruit-spotting bugs

Plant hoppers

Tea mosquito bugs

- Mobile
  - Contact
- Sap suckers
  - Translaminar & systemic

Bugs

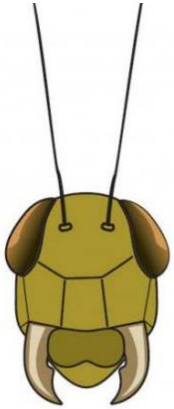


Mango shoot caterpillar

Flower caterpillar

Mango fruit borer

- What's the go to product?



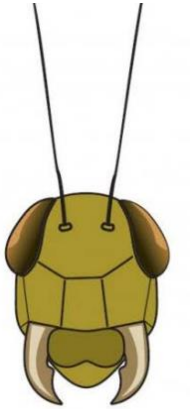
Caterpillars

Longicorn beetle

Swarming beetle

Red shouldered leaf beetle

- What's the go to product?



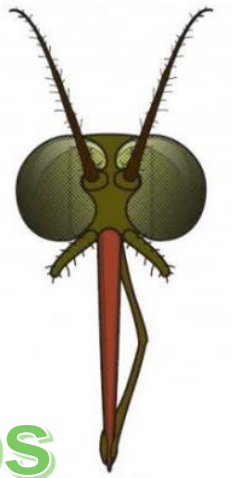
Beetles

Mango bud mite

Mango leaf coating mite

Flower thrips

- What's the go to product?



Mites, thrips

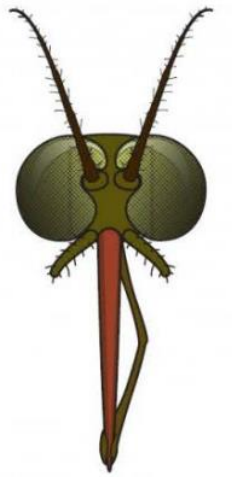
Mealybugs

Fluted scale

Mango scale

- What's the go to product?

Scale
Mealybugs



Bringing it all together

Effective

Beneficial insects

Resistance management

Your options

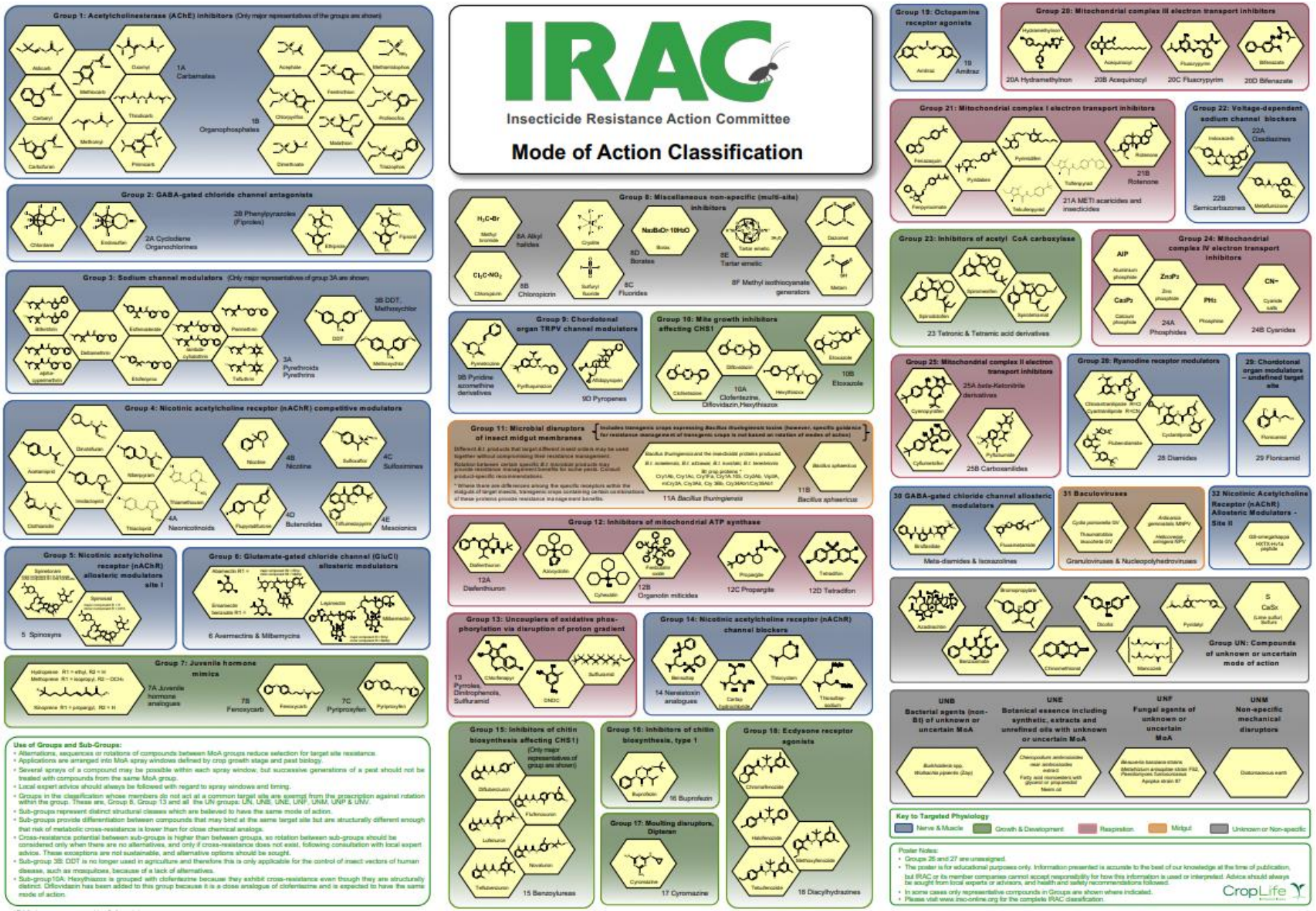
Registered insecticides

ACTIVES	GROUP	Number of registered products	Insects controlled
BUPROFEZIN	16	6	Scale
CARBARYL	1A	5	Scale, leafhopper, planthopper
CHLORPRYIFOS	1B	38	Scale
DIMETHOATE	1B	20	Fruit fly
METHIDITHION	1B	2	Scale, Mango tip borer, leafminer, Mango Seed weevil
PARAFINIC OIL	-	3	Scale, planthopper
PETEROLEUM OIL	-	3	Scale
SPINETORAM	5	1	Flower eating caterpillar, Mango tip borer
SPIROTETRAMAT	23	1	Scale

7 out 9 registered actives control scale

PERMITS

ACTIVES	GROUP	Expires	Insects controlled
FIPRONIL	2B	Mar-23	Termite
SULFOXAFLOR	4C	Mar-23	Fruit-spotting bug
METHOMYL	1A	Nov-20	Thrips
CLOTHINIDIN	4A	Aug-19	Mango seed weevil (S)
MALDASON	1B	Aug-22	Fruit fly
CLOTHINIDIN	4A	Nov-20	Fruit fly
BETA-CYFLUTHRIN	3A	Aug-22	Fruit-spotting bug, Rhino beetle, Monolepta, longicorn beetle, tip borer, planthopper, green vegetable bug, stink bugs, yellow peach moth
CARBARYL	1A	Jun-20	Leafhopper
TRICHLORFON	1B	Jun-20	Fruit-spotting bug (S), green vegetable bug (S), Lychee stink bug (S) planthopper, flower feeding caterpillar, yellow peach moth


IRAC
Insecticide Resistance Action Committee
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3A Pyrethroids Pyrethrins
3B DDT, Methoxychlor
Group 4: Nicotinic acetylcholine receptor (nAChR) competitive modulators
4A Neonicotinoids
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4D Butenolides
4E Mesoionics
Group 5: Nicotinic acetylcholine receptor (nAChR) allosteric modulators site I
5 Spinosyns
Group 6: Glutamate-gated chloride channel (GluCl) allosteric modulators
6 Avermectins & Milbemycins
Group 7: Juvenile hormone mimics
7A Juvenile hormone analogues
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7C Pyriproxyfen
Use of Groups and 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 should always be followed with regard to spray windows and timing.
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• 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.
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• 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.
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8C Fluorides
8D Borates
8E Tartar emetic
8F Methyl isothiocyanate generators
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9B Pyridine azomethine derivatives
9D Pyropenes
Group 10: Mite growth inhibitors affecting CHS1
10A Clofentezine, Diflovidazin, Hexythiazox
10B Etoxazole
Group 11: Microbial disruptors of insect midgut membranes
{Includes transgenic crops expressing Bacillus thuringiensis toxins (however, specific guidance for resistance management of transgenic crops is not based on rotation of modes of action)}
11A Bacillus thuringiensis
11B Bacillus sphaericus
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12A Diafenthiuron
12B Organotin miticides
12C Propargite
12D Tetradifon
Group 13: Uncouplers of oxidative phosphorylation via disruption of proton gradient
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17 Cyromazine
Group 18: Ecdysone receptor agonists
18 Diacylhydrazines
Group 19: Octopamine receptor agonists
19 Amitraz
Group 20: Mitochondrial complex III electron transport inhibitors
20A Hydramethylnon
20B Acequinocyl
20C Fluacrypyrim
20D Bifenazate
Group 21: Mitochondrial complex I electron transport inhibitors
21A METI acaricides and insecticides
21B Rotenone
Group 22: Voltage-dependent sodium channel blockers
22A Oxadiazines
22B Semicarbazones
Group 23: Inhibitors of acetyl CoA carboxylase
23 Tetronic & Tetramic acid derivatives
Group 24: Mitochondrial complex IV electron transport inhibitors
24A Phosphides
24B Cyanides
Group 25: Mitochondrial complex II electron transport inhibitors
25A beta-Ketonitrile derivatives
25B Carboxanilides
Group 28: Ryanodine receptor modulators
28 Diamides
Group 29: Chordotonal organ modulators – undefined target site
29 Flonicamid
30 GABA-gated chloride channel allosteric modulators
Meta-diamides & Isoxazolines
31 Baculoviruses
Granuloviruses & Nucleopolyhedroviruses
32 Nicotinic Acetylcholine Receptor (nAChR) Allosteric Modulators - Site II
Group UN: Compounds of unknown or uncertain mode of action
UNB Bacterial agents (non-Bt) of unknown or uncertain MoA
UNE Botanical essence including synthetic, extracts and unrefined oils with unknown or uncertain MoA
UNF Fungal agents of unknown or uncertain MoA
UNM Non-specific mechanical disruptors
Key to Targeted Physiology
Nerve & Muscle
Growth & Development
Respiration
Midgut
Unknown or Non-specific
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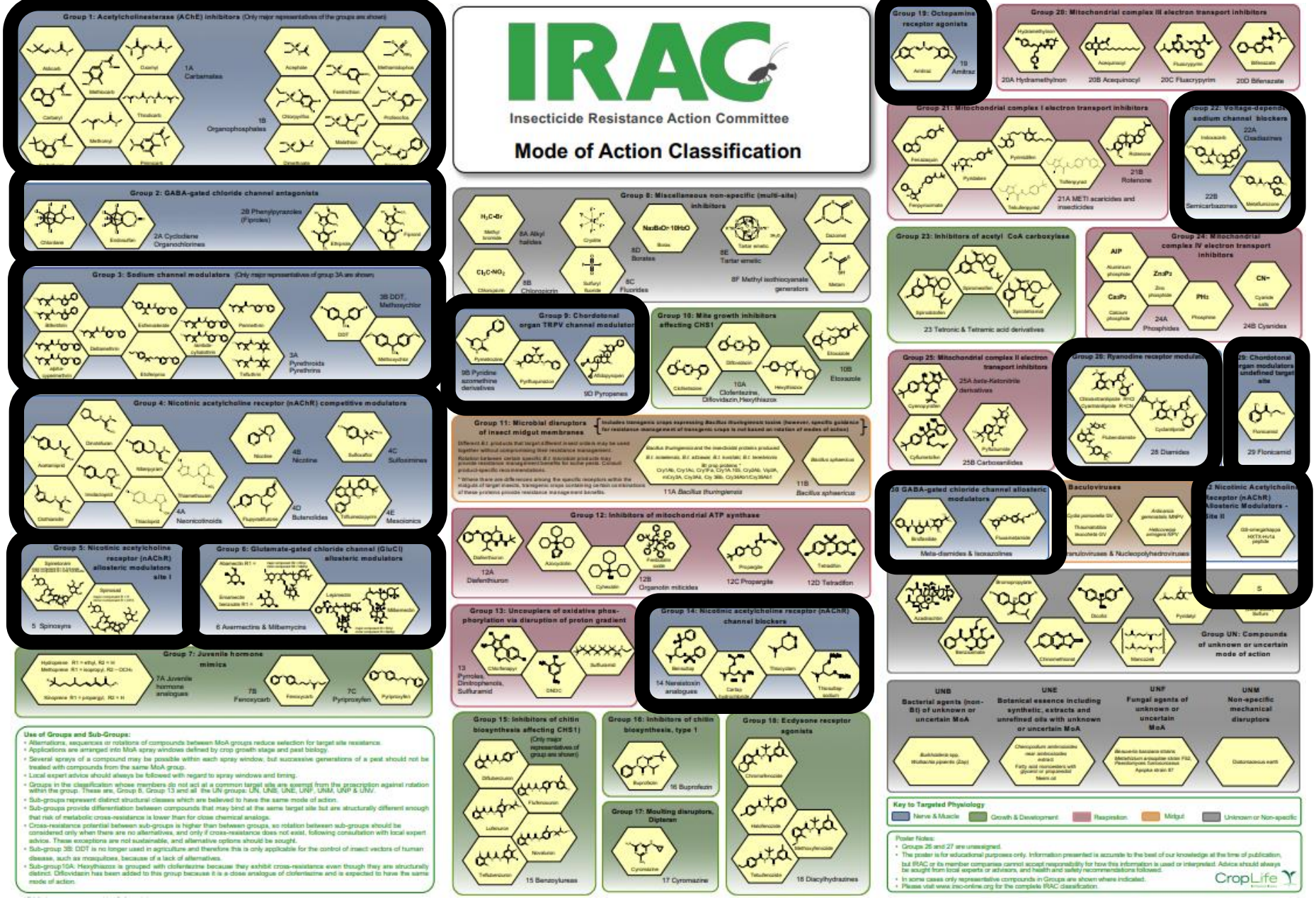
CropLife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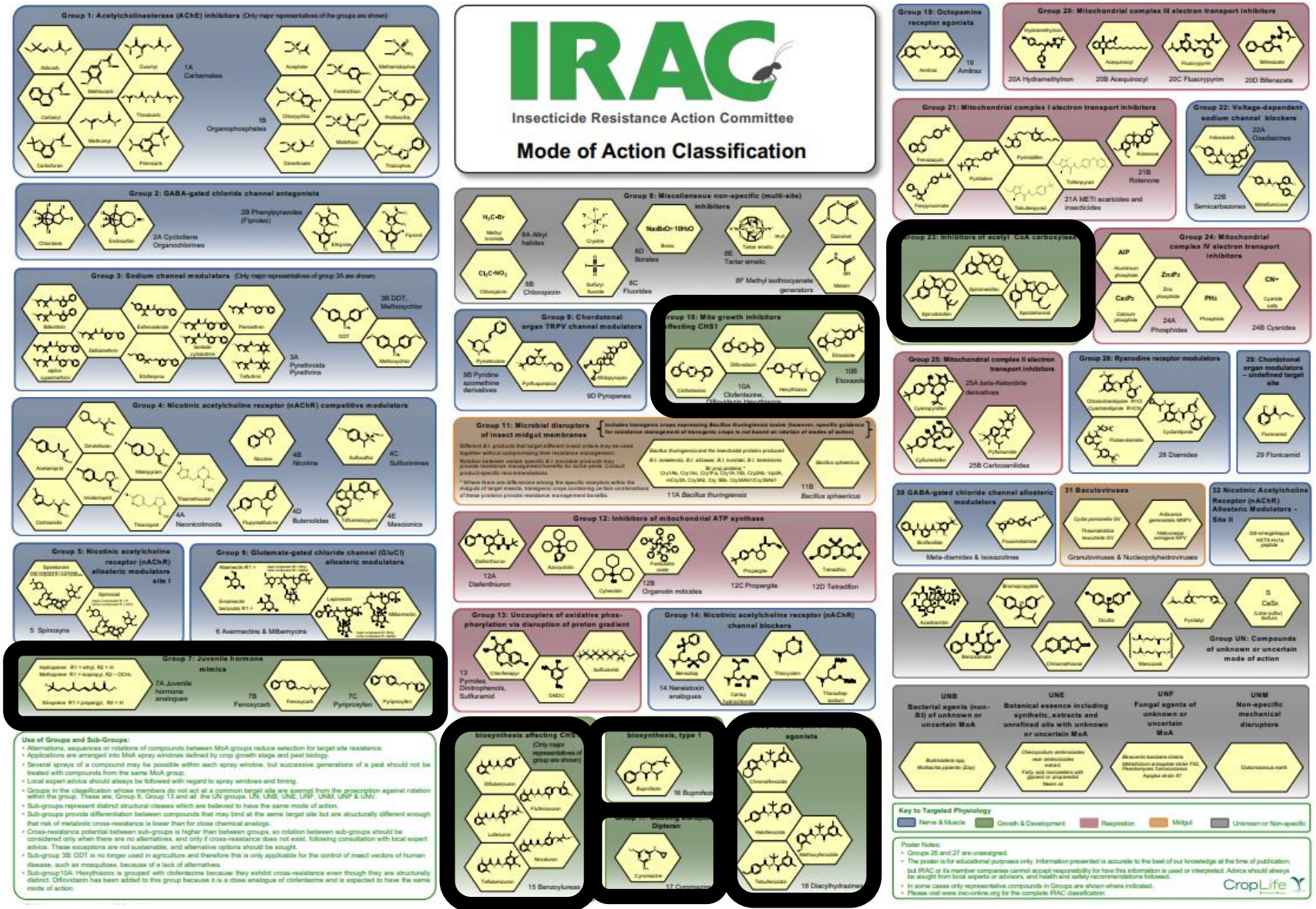
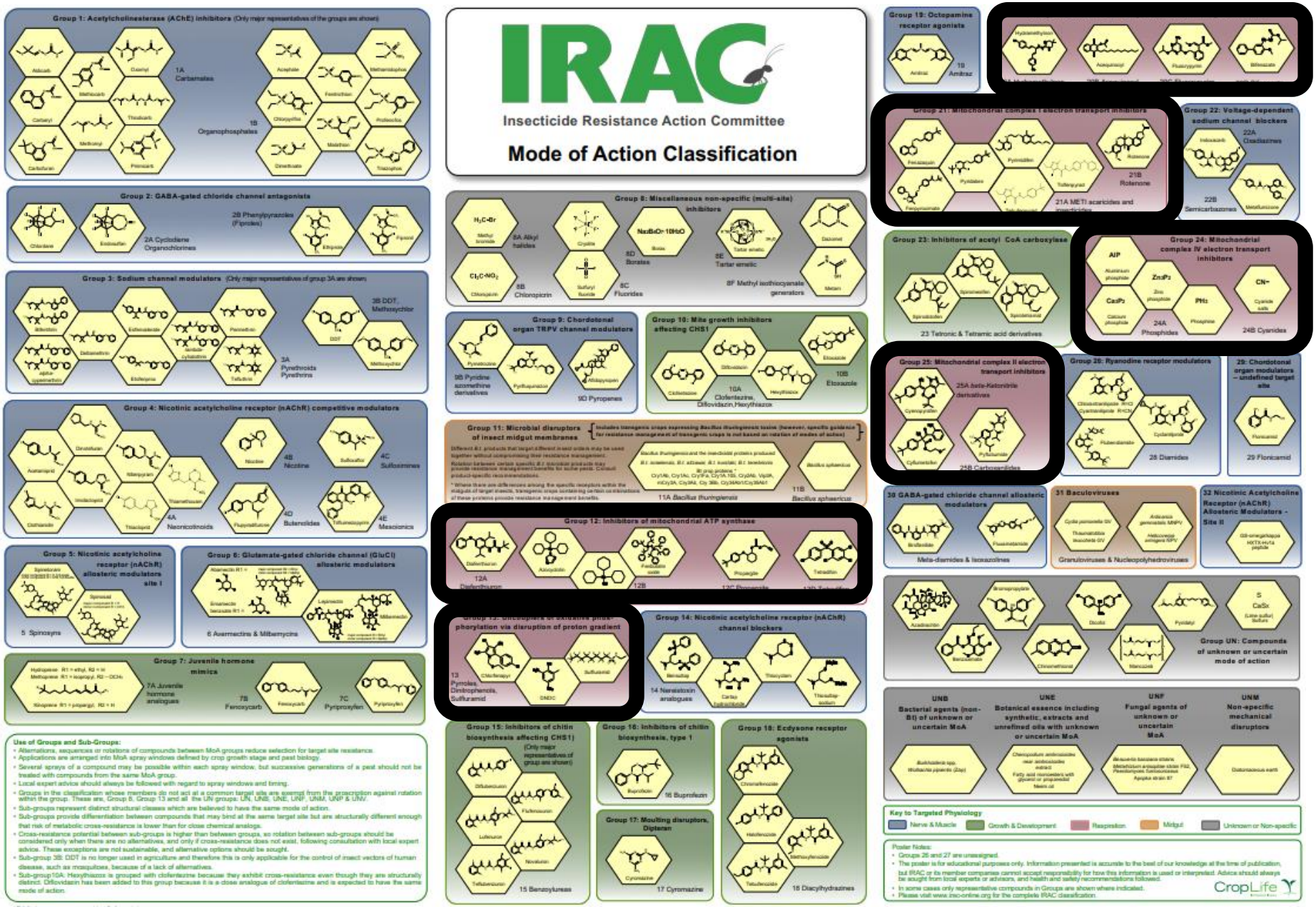


Growth and Development

syngenta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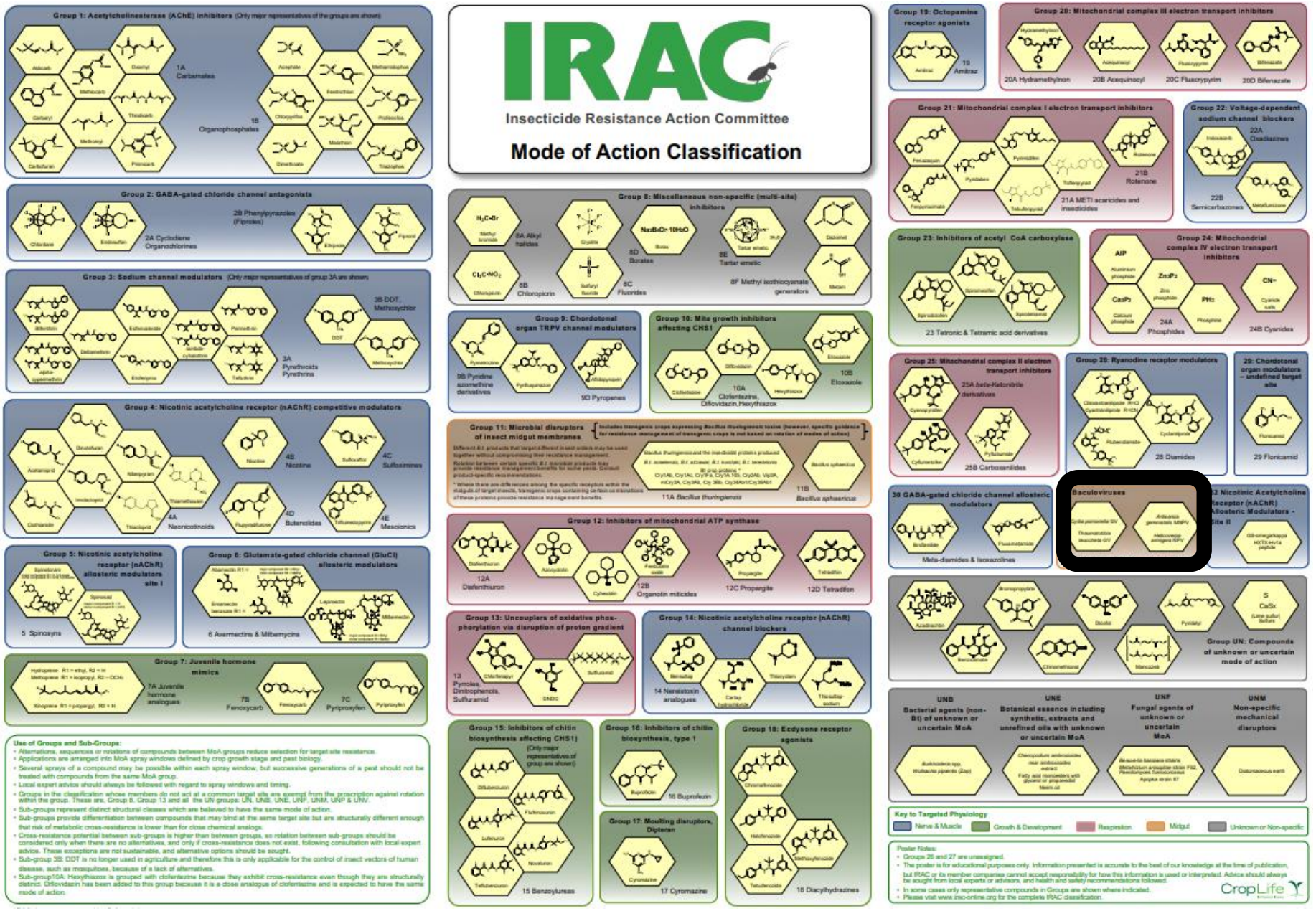
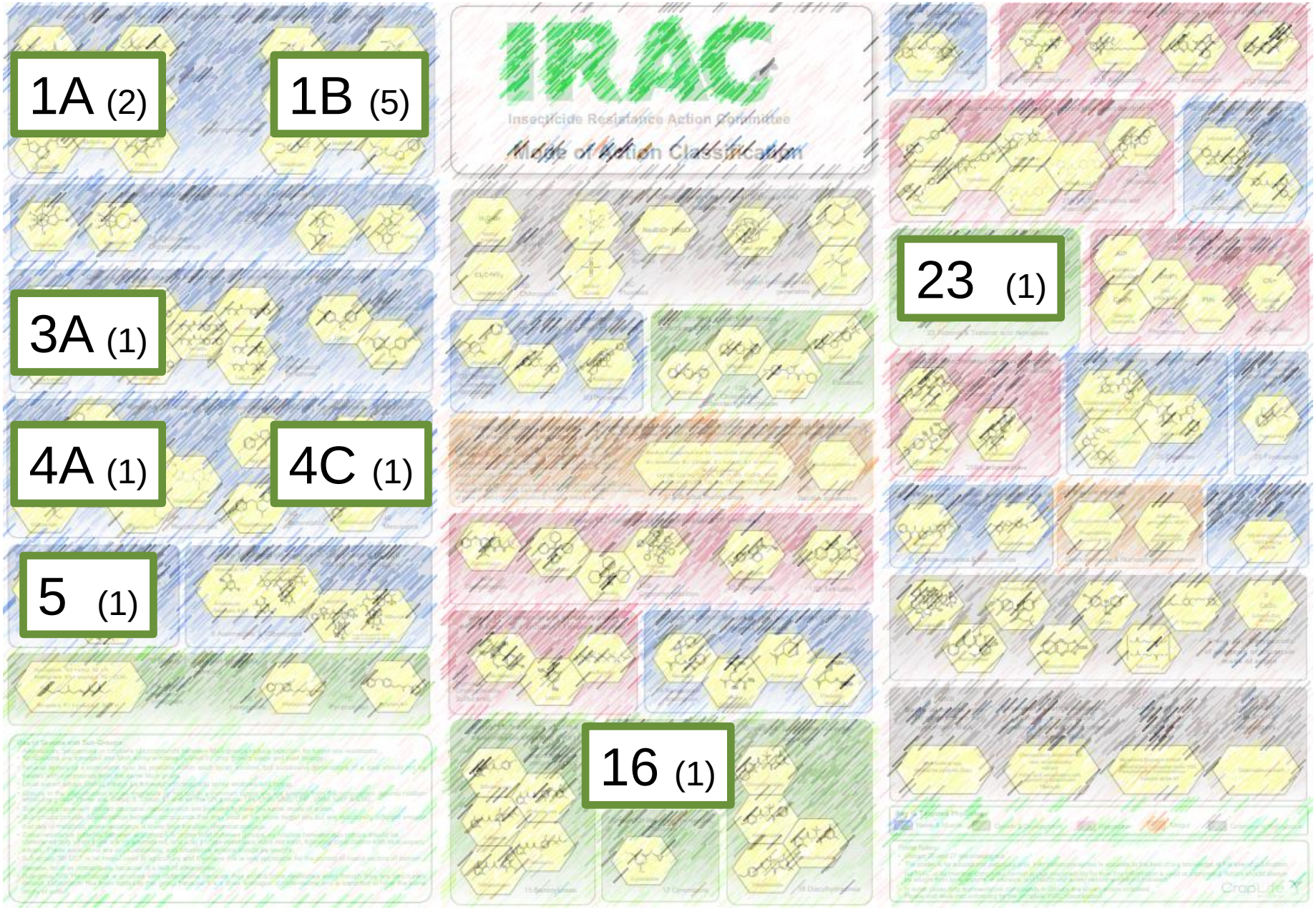
8A Alkyl halides
8B Chloropicrin
8C Fluorides
8D Borates
8E Tartar emetic
8F Methyl isothiocyanate generators
Group 9: Chordotonal organ TRPV channel modulators
9B Pyridine azomethine derivatives
9D Pyropenes
Group 10: Mite growth inhibitors affecting CHS1
10A Clofentezine, Diflovidazin, Hexythiazox
10B Etoxazole
Group 11: Microbial disruptors of insect midgut membranes
{Includes transgenic crops expressing Bacillus thuringiensis toxins (however, specific guidance for resistance management of transgenic crops is not based on rotation of modes of action)}
11A Bacillus thuringiensis
11B Bacillus sphaericus
Group 12: Inhibitors of mitochondrial ATP synthase
12A Diafenthiuron
12B
Group 13: Uncouplers of oxidative phosphorylation via disruption of proton gradient
13 Pyrroles, Dinitrophenols, Sulfluramid
Group 14: Nicotinic acetylcholine receptor (nAChR) channel blockers
14 Nereistoxin analogues
Group 15: Inhibitors of chitin biosynthesis affecting CHS1 (Only major representatives of group are shown)
15 Benzoylureas
Group 16: Inhibitors of chitin biosynthesis, type 1
16 Buprofezin
Group 17: Moulting disruptors, Dipteran
17 Cyromazine
Group 18: Ecdysone receptor agonists
18 Diacylhydrazines
Group 19: Octopamine receptor agonists
19 Amitraz
Group 21: Mitochondrial complex I electron transport inhibitors
21A METI acaricides and insecticides
21B Rotenone
Group 22: Voltage-dependent sodium channel blockers
22A Oxadiazines
22B Semicarbazones
Group 23: Inhibitors of acetyl CoA carboxylase
23 Tetronic & Tetramic acid derivatives
Group 24: Mitochondrial complex IV electron transport inhibitors
24A Phosphides
24B Cyanides
Group 25: Mitochondrial complex II electron transport inhibitors
25A beta-Ketonitrile derivatives
25B Carboxanilides
Group 28: Ryanodine receptor modulators
28 Diamides
29: Chordotonal organ modulators – undefined target site
29 Flonicamid
30 GABA-gated chloride channel allosteric modulators
Meta-diamides & Isoxazolines
31 Baculoviruses
Granuloviruses & Nucleopolyhedroviruses
32 Nicotinic Acetylcholine Receptor (nAChR) Allosteric Modulators - Site II
Group UN: Compounds of unknown or uncertain mode of action
UNB Bacterial agents (non-Bt) of unknown or uncertain MoA
UNE Botanical essence including synthetic, extracts and unrefined oils with unknown or uncertain MoA
UNF Fungal agents of unknown or uncertain MoA
UNM Non-specific mechanical disruptors
Key to Targeted Physiology
Nerve & Muscle
Growth & Development
Respiration
Midgut
Unknown or Non-specific
Poster Notes:
Groups 26 and 27 are unassigned.
The poster is for educational purposes only. Information presented is accurate to the best of our knowledge at the time of publication, but IRAC or its member companies cannot accept responsibility for how this information is used or interpreted. Advice should always be sought from local experts or advisors, and health and safety recommendations followed.
In some cases only representative compounds in Groups are shown where indicated.
Please visit www.irac-online.org for the complete IRAC classification.
CropLife

syngenta

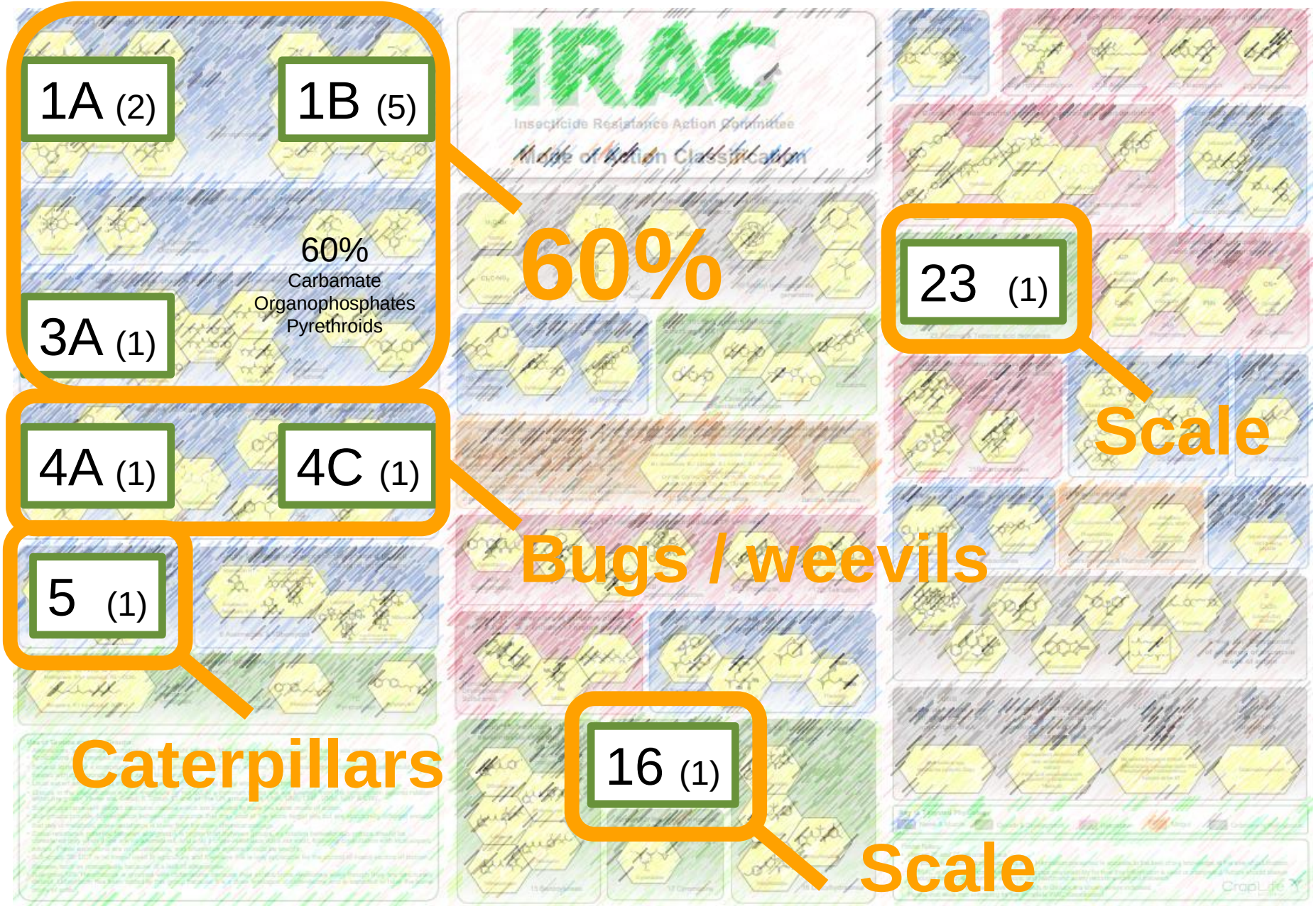


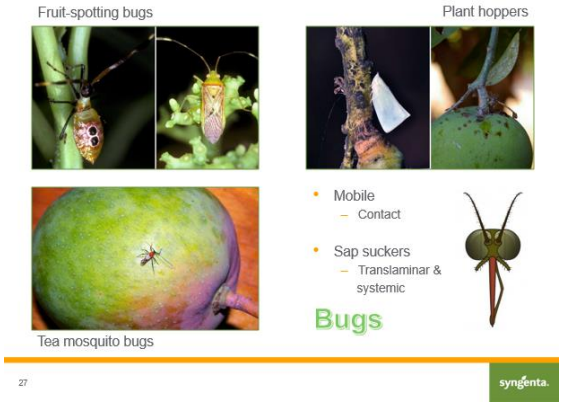
Midgut

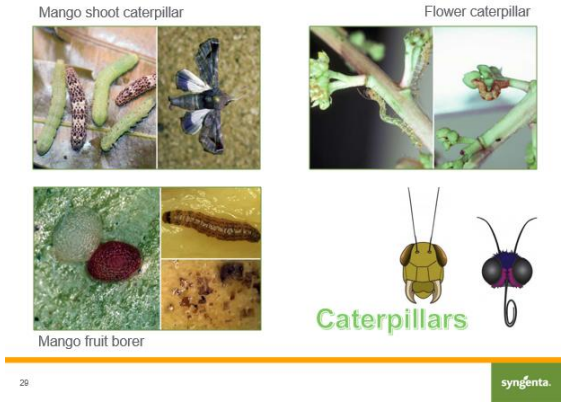
syngenta

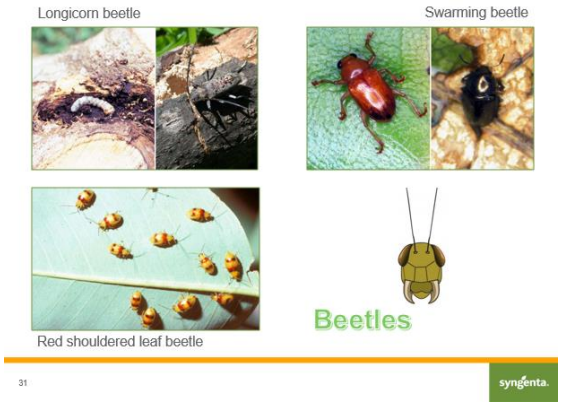

1A (2)
1B (5)
IRAC
Insecticide Resistance Action Committee
Mode of Action Classification
3A (1)
23 (1)
4A (1)
4C (1)
5 (1)
16 (1)

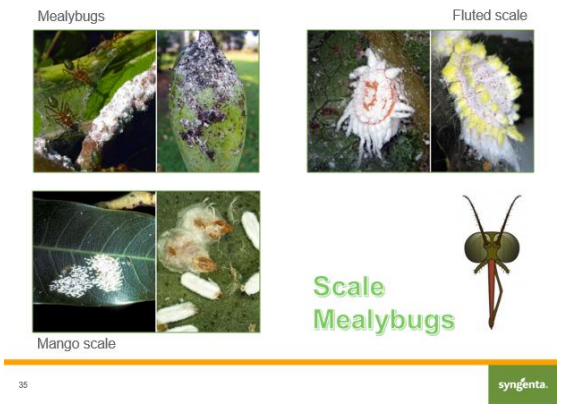
syngenta

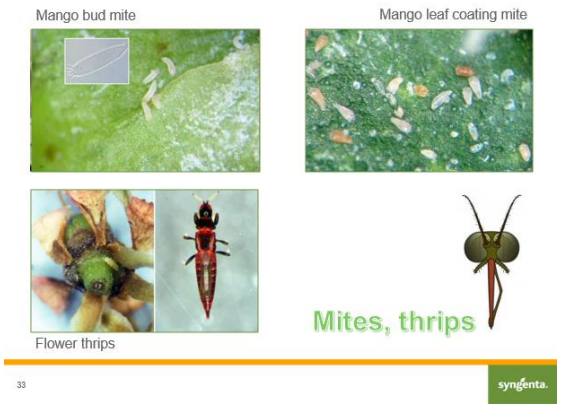

1A (2)
1B (5)
60%
Carbamate
Organophosphates
Pyrethroids
3A (1)
60%
23 (1)
Scale
4A (1)
4C (1)
Bugs / weevils
5 (1)
Caterpillars
16 (1)
Scale











Are there any gaps?