

International Working Group & Country Group Review 46<sup>th</sup> Meeting of IRAC International, Brussels, Belgium

Wednesday - March 30<sup>th</sup>, 2011

Mode of Action WG Tom Sparks







## **MoA Classification Objectives**

**Insecticide Resistance Action Committee** 

The IRAC Mode of Action (MoA) classification provides farmers, growers, advisors, extension staff, consultants and crop protection professionals with a guide to the selection of insecticides or acaricides for use in an effective and sustainable insecticide or acaricide resistance management (IRM) strategy.

# **RAC** Mode of Action WG

**Insecticide Resistance Action Committee** 

## Team Members 2010 / 2011

- Nigel Armes BASF
- Georgina Bingham Vestergaard Frandsen
- Dan Cordova DuPont
- Fergus Earley Syngenta
- Peter Luemmen Bayer
- Danny Karmon MAI
- Nobuaki Mito Sumitomo
- Ralf Nauen Bayer
- Vincent Salgado BASF Deputy
- Tom Sparks Dow Chair
- Jerry Watson Dow
- Alan Porter (IRAC)

# IRAC

## MoA Team Activities 2010/11

Insecticide Resistance Action Committee

## Since 2010

- Washington D.C meeting (12 participants and several guests)
- Three conference calls
  - July . 2010 (8 participants)
    Oct. 2010 (8 participants)
    Jan. 2011 (9 participants)
- This week F2F meeting + concall
  - (9 participants and several guests)
  - Session 2D (Brussels, March 29<sup>th</sup>)

Company participation since 2008 has expanded from four (4) to eight (8) companies

- BASF, Bayer, Dow, DuPont, Makhteshim-Agan, Sumitomo, Syngenta, Vestergaard Frandsen
- Other company representatives have also participated and are welcome to join.



- IRAC Website Most popular web page Mode of Action
  - MOA Team page was viewed 8,557 (-18%)
  - MOA classification scheme was downloaded 2,190 (+15%)
- Most popular resource IRAC Posters: total downloads = 5,240
  - 61% (3,188) were related to MoA
  - MOA structure poster downloads = 1,227
    - Spanish = 592, English = 499 (-29%), Portuguese = 76, Chinese = 58
  - MoA Sucking Insects = 300
  - General MoA = 298
  - MoA Leps = 296
  - MoA Mites = 259
  - MoA Mosquito = 193



#### Goals & SMART Objectives (for 2010/11)

Goals	Objectives	Timeline
Continue to review and update the MOA scheme as required.	<ul> <li>Update as needed the current Version 7.0 to include any changes and / or new actives.</li> </ul>	In progress
Develop new versions of the	<ul> <li>Using the new version of the scheme (V7.0) update the MOA Structure poster</li> </ul>	Completed
MOA Structure Poster as needed	<ul> <li>Work with the C&amp;E WG to print copies (v7.0) for distribution</li> </ul>	On hold
Develop non English versions	<ul> <li>Develop Portuguese-language version of the MoA Structure poster</li> </ul>	Completed
of the MOA Structure Poster – with C&E WG	<ul> <li>Develop other language versions of the MoA structure poster</li> </ul>	Under discussion
Update other MOA posters	<ul> <li>Work with C&amp;E Team to incorporate any updates from new versions of the MoA Scheme into Pest MOA posters</li> </ul>	In progress
	Update General MoA Poster	Competed
Develop MoA Diagrams.	<ul> <li>Provide MoA diagrams for the different broad MoAs (IGR, vs neural, vs. respiration) for use in MoA publications and presentations.</li> </ul>	Still in progress



### Goals & SMART Objectives (for 2010/11)

Goals	Objectives	Timeline
Develop MoA WG presentation	<ul> <li>Develop a general MoA oral presentation that can be used at scientific meetings</li> </ul>	In progress
Develop Resistance mechanisms Poster	<ul> <li>Develop a general poster on mechanisms of insecticide resistance</li> </ul>	In progress

# IRAC

## MoA Team Activities 2010/11

**IRAC MoA Classification** 

Insecticide Resistance Action Committee

#### Updated MoA Scheme

- Aug. 2010 (version 7.0)
  - addition of new compounds to some groups
    - e.g. Group 13 sulfoluramid
  - addition of procedures as an appendix
  - addition of a compound index
  - addition of MoA descriptors
  - other minor revisions of wording

#### - Next version (8.0)

- Potential addition of several compounds to existing groups
  - Group 25 cyflumetofen
  - Group 28 cyanthriliprole
  - Group UN pyrifluquinazon
  - Group 6 lepimectin
- other minor revisions

#### 6.2. Classification Table IRAC MoA Classification v 7.0, August 2010 1 Chemical Sub-group Main Group and **Active Ingredients** Primary Site of or exemplifying Action Active Ingredient Alanycarb, Aldicarb, Bendiocarb, Benfuracart tylcholinesterase Carbamates Butocarboxim, Butoxycarboxim, Carbaryl, Carbofuran. (AChE) inhibitors Carbosulfan, Ethiofencarb, Fenobucarb, Formetanate Furathiocarb, Isoprocarb, Methiocarb, Methomyl, Nerve action Metolcarb, Oxarnyl, Pirimicarb, Propoxur, Thiodicarb, Thiofanox, Triazamate, Trimethacarb, XMC, Xylylcarb (Strong evidence that Acephate, Azamethiphos, Azinphos-ethyl, Azinphosaction at this protein is Organophosphates responsible for methyl, Cadusafos, Chlorethoxyfos, Chlorfenvinphos, Chlormephos, Chlorpyrifos, Chlorpyrifos-methyl, insecticidal effects) Coumaphos, Cyanophos, Demeton-S-methyl Diazinon, Dichlorvos/ DDVP, Dicrotophos, Please see footnotes for Dimethoate, Dimethylvinphos, Disulfoton, EPN, further information on the Ethion, Ethoprophos, Famphur, Fenamiphos, use of compounds Fenitrothion, Fenthion, Fosthiazate, Heptenopho between sub-groups Imicyafos, Isofenphos, Isopropyl O-(methoxyaminothio-phosphoryl) salicylate, Isoxathion. Malathion, Mecarbarn, Methamidophos, Methidathion, Mevinphos, Monocrotophos, Naled, Omethoate, Oxydemeton-methyl, Parathion, Parathion-methyl, Phenthoate, Phorate, Phosalone, Phosmet Phosphamidon, Phoxim, Pirimiphos- methyl Profenofos, Propetamphos, Prothiofos, Pyraclofos Pyridaphenthion, Quinalphos, Sulfotep, Tebupirimfos Temephos, Terbufos, Tetrachlorvinphos, Thiometon, Triazophos, Trichlorfon, Vamidothion GABA-gated chloride Cyclodiene Chlordane, Endosulfan channel antagonists organochlorines Nerve action Strong evidence that Phenylpyrazoles Ethiprole Fipronil action at this protein is (Fiptoles) responsible for secticidal effects) Acrinathrin, Allethrin, d-cis-trans Allethrin, d-trans Sodium channel Pyrethroids Allethrin, Bifenthrin, Bioallethrin, Bioallethrin Smodulators cyclopentenyl isomer, Bioresmethrin, Cycloprothrin, Cyfluthrin, beta-Cyfluthrin, Cyhalothrin, lambda-**Pyrethrins** Nerve action Cyhalothrin, gamma-Cyhalothrin, Cypermethrin, Estrong evidence that alpha-Cypermethrin, beta-Cypermethrin, thetaaction at this protein is cypermethrin, zeta-Cypermethrin, Cyphenothrin, responsible for trans- isomers], Deltamethrin, Empenthrin , (EZ)- (1R)insecticidal effects} isomers], Esfenvalerate, Etofenprox, Fenpropathrin, Fenvalerate, Flucythrinate, Flumethrin, tau-Please see footnotes for Fluvalinate, Halfenprox, Imiprothrin, Kadethrin, further information on the Permethrin, Phenothrin [(1R)-trans- isomer], use of compounds Prallethrin, Pyrethrins (pyrethrum), Resmethrin, Silafluofen, Tefluthrin, Tetramethrin, Tetramethrin between sub-groups [(1R)-isomers], Tralomethrin, Transfluthrin, DDT DDT Methoxychior Methoxychlor

Version: 7.0



**Insecticide Resistance Action Committee** 

## Updated MoA Structure Poster (currently v7.0)

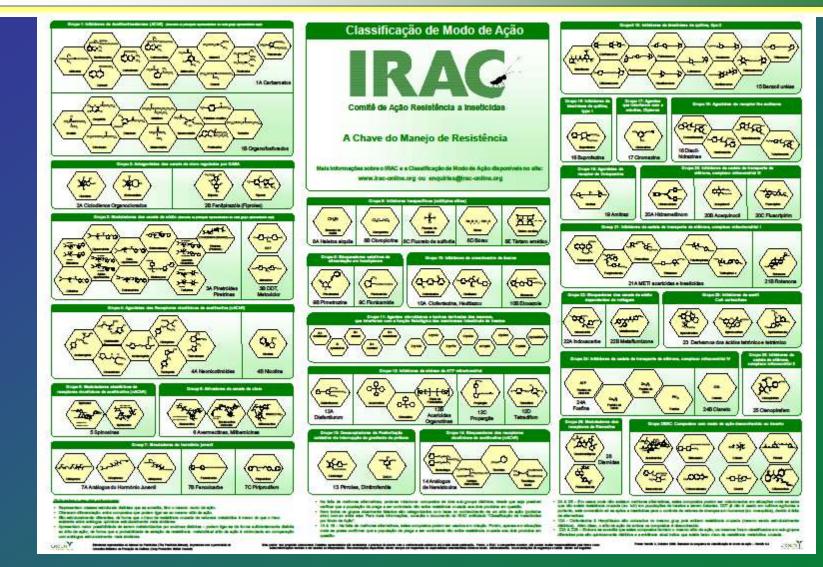
- minor revisions of some wording
- addition of new compounds to some groups
  - e.g. UN pyrifluquinazon

## Next version – when needed

- MoA Structure Poster Translations (version 2 based on scheme 6.3)
  - Portuguese completed this year
  - Other languages (Spanish and Chinese were completed last year) will need updating
  - Other languages under consideration
    - French, German, Japanese



**Insecticide Resistance Action Committee** 



### **Portuguese Version of MoA Structure Poster**



Note that homogeneous devices a local heigh of why effects machines to the cares of sharing the devices handles the devices handles the devices handles the devices handles the devices here the devices here the devices here the devices here the devices handles the devices here the devices here the devices here the device here there there there the device here the

which we do not be sensed on the set of the

Hold in the president of ector approximation approximation in Provincial Intel Committee, 2-Cylandryn.

by 42-16 given a factor of provide themes intuition taking particular.

Conference of the property of the second sec

the second balling including individual allocation and that a work in a second particulation of the network

reading repairing the screek.

Insecticide Resistance Action Committee

#### **Pest Group MoA Posters** Completed

- Lepidoptera
- Sucking Insects
- Mites
- Mosquitoes
- General MoA poster
  - Two versions

### Next versions

- Resistance Mechanisms
- Updates on current posters as needed



NU DINNE I NUE TH

THE ILL MERSING, TH

The approx action of actuations a nAtivate country of

Antis Tayof premiy the artrop

#### Lepidoptera Insecticide Mode of Action Classification: A key to effective insecticide resistance management

Insecticide Resistance Action Committee

www.irac-online.org



and of locks that are defined to the place of



ites. Post and ret I HAMPING THE DUTIES OF THE OWNER OWNE OWNER OWNE

direct if Ministerial Longitud, Articlian Internet Stationers, Sta

Meaged Targets Once 11 Monifold de sector, of local sideot mento mano como mecono o recordo e todores de 144 milior remais des relaciones esta alebraria. Bachar homogener, Bachar sonarmas

now To and Development Tarbella

a Apple provide the provide the ment are generally shown in tracements Anna I. Annalis and an altern Annalis for the second states and No. and the second states and the first

Record Contractions of Address Street Street, Track of Management and Street St

#### Acaricide Mode of Action Classification: A key to effective acaricide resistance management

and in this is that she defined by the state of the own

Effective IRM strategies: Sequences or alternations of MoA

in the later

ter recitarce management for acarter per

www.irac-online.ovp

a tente dina a



Introduction INTO disactions AND provide the set of a last of notice test constroler of matchine and available as the last to effective and subarative instructor transmission and obtained provide and last in the legal as . Review and encode particular, the Rec last instruction, present address participation, present and reactivation into provides territoria granateta. the off A date to the lost provides and inserticides in resistance management programs estimate framagements of the task presented the 2015 and a selation summittee. A remember of winners land groups is shown

Insecticide Resistance Action Committee

Nerve and Muscle Targets layout control approximation and in more and muscle layout hearings that all on manipular layout it this update are privately fact within

Hybrid Sciences (ACME 2008) in Vesting Systematicities. ACME althe responsibility investigation resultation information and an analysis of access. mp. Settians), 18 Organizmentatis (mp.

Sing J Side and Main States and recommended freemings

andium charters spek, searing hyperschildum and, in contra cases, verye boa understell an husben in the propagator of advert solarities advectered advect device, hyperboards age difference, equilations failure and, in cards Lines, meyer lives

commences and de polariste pare, crowing charges (0.4) stantile is an incorrer, moduly resolution of the resets Denotics in p. Reaments, Indiannes

aver maxim, wang o systemation. Organise o be next alreade, lie give fait readanties into write:

Acaricides for which the mode of action is unknown There compares are not capable, because there is not sufficient information accessive on their most of access. explored Designed Computing Schure



#### Proton but if to get reputation between Respiration Targets

the electronic response planets produce AT which receiptes a visa officer process reconcerts, an electron reproduct cher una the energy respond to another is show the eleves, blytte autoute an month is define with many sector target anno property choose when she at an

map 12 Intelligies of estimatesideal 477 spectrums

dicteration, the preven receipt ing Application, Network, MC Provide Singe 12 Uncounted of initiality properties that descents of the process granted representation and contracting the relationship process product acting VP pay rules Distriction.

Group 27 Miles could be done interpret compares 6, preventing the valuation of strange by calls.

Broop Of Mitochemical company index the descent indexters matrix-sectors transition company, presenting the distances of energy by call. 2nd Milling and company, presenting the distances of energy by call.

Security of Millia Interacting Concerning Technology of Concerning Technology on Security Technology on Security

Growth and Development Targets failure ris good report acts minor pool fances, is decir enable acts tender, in actionations, barries for an anticipation of sould use along Tor and potential in the least follow.

ling II Bis profi idélies. Inargeny déni nub d'alter natig à post mission 14 comptes, Assimant, 100 (conce

Course 12 Interdance of adda interpretation, April Interpretation, defined made of action stating is held semalarization may Proceeding Mathematics.

Not per compress a categorie per of the that per in tent insurface before a theorem and defensive reg. (productive)

# IRAC

## MoA Team Activities 2010/11

**Insecticide Resistance Action Committee** 

## MoA Booklet – 1<sup>st</sup> edition completed last year

- pocket sized
- Includes more information
  - MoA classification
  - aspects from Pest group MoA posters
  - alphabetical listing of ai's with MoA classification
- 2010/11 >3000 copies distributed

## ■ MoA Booklet – 2<sup>nd</sup> edition

updating in progress
 A Spanish version being considered



REATING TO T		Surgeratten	BA 3	Cyanada.	248	from the benchmark	
Acaphata	54	Bassetharons				Emperifyie	1
Aureparenty.	ALC: N	Bull be	80	Symmetrice	2.8	(167)-(100 -tamert)	1.
Acatamprid	- 44-	Engelativesia	10	Cydngrothess	34	Andrew Can	12
Acronation	14	Button at Tagarm	14	Overstanden	29.	are and a second second	
Manycare	16	BANNycarbonim.	14	Ddiametadara	5.91		1
Addrests	LR.	Catheiafree	18 .	Cytasheve	AL:	(Estanationate	1
Anthron	14	Califul phonyman	744	Cybalatton	16	Interfercate	1
sight Commentation	34	Cattery	14	Ortevent	128	Etter	10
Alumanum phongings	244	Caladieve	IA	Calence and the lot	18	- Ethoprophes	1
Annuas	19	Carbonation	JA .	Capturation	-	Dofergesa	1.14
headencircle	10	Cartas hydrochuscae	14	\$183-trans-isomersi	24	finaire.	3.0
Acamethybox	19	Etwanterilaneat	1.04	Landmaning	17	fartatur	11
Accepton-Attal	18	Olimartiguilante	14	Bill tight Albettute	24	Ferrareitafelte	-11
Arrenten methol	18	Osaure	1929	Start .	1.20	Personal and	13
Austoristic	128	Chievethawire	18	Detterhethine	-34	Fundamentin parale	11
Battlen	100	Charlemapp.	43	Derverses & contract		Parteroritain	11
tharing tensis / turimetricus.	-11	Overferstrighter	18	Diaferthiania	1.0	Fanebucarb	- 24
Perdiscaria	14	Ceseffuggeran	15	Gaateer	128	Fertpropatierer	84
Berforatiet		Otomashos	18		18	Farmyrtacenaia	11
Berrindian	1A TA	Champertie	8.0	Childentes/ DDV#	1.18	Auration	1
Bangani Parks	100	Chiergyother	38	Delafat	UN:	Foregatata	14
here Caffallers	34	Chierpy fee control	1.6	BERT WITH MAN	39.1	Thirry group	- 91
Anta-Cappermethese	- 24	Chungbounder	.38	diffuternation	. 13	Shanchystyren	200
the state of the s		Contraction	. 111A	Depethonia	18	The states and	
1	Life	Colligande	144.1	Deterthytwingfield	3.0	Paractiments	18
	54	Chimteshoe	1.18	Endetwar	46	Finitetterane	3.4
	34	Christian	18	(Distal Status)		Patenceston	10
	34	Crystere	1.04	THAN	1.8	(Barrastola)	14
and the second second	6-38-	(parisk	1.398.3	The statest Address of	34.		A.
							T.
-	1.85	Advertigence of the local data	1.75.3	Distantion.	1.00.3	(Tathatanan I	-
Construction of the local division of the lo	1.22	Added to prove of the second second	12	Protection of the	100	hitteres.	188.
(PROPERTY OF CO.	44	· BAUTTER DE LEVERE	1.64	Property and	100	Techarbert	-32
and the second s	10.1	ADALETCO (R.		an opposite of	1.00	These and these of suffrage	100



**Insecticide Resistance Action Committee** 

## Presentations on IRAC MoA WG & MoA Scheme

- 29<sup>th</sup> Meeting of the Entomological
   Society of Israel
  - 4 Posters D. Karmon
  - Beit Dagan, Israel, Oct. 2010



- 2011 Beltwide Cotton Conference
   Poster T. Sparks Atlanta, GA, Jan. 2011
- 2011 Texas Consultants meeting
   Part of oral presentation G. Thompson Mar. 2011



### Goals & SMART Objectives (for 2011/12)

Goals	Objectives	Timeline
Continue to review and update the MOA scheme as required.	Update as needed the current Version 7.0 to 7.1 to include new actives / classifications	On-going
Continue to review & update MoA Booklet	<ul> <li>Update MoA booklet (2<sup>nd</sup> ed) – incorporate changes in 7.1</li> </ul>	asap
Develop new versions of the	<ul> <li>Using the new version of the scheme (V7.1) update the MOA Structure poster</li> </ul>	2Q 2011
MOA Structure	• Work with the C&E WG to print copies (v7.1) for distribution	2-3Q 2011
Poster (with C&E	Update current non-English versions	3Q 2011
WG) as needed	<ul> <li>Develop other language version of the MoA Structure poster</li> <li>(French, <i>Japanese, German</i>)</li> </ul>	4Q 2011
Update other MOA posters	Work with C&E WG to incorporate updates from new versions     of the MoA Scheme into Pest MoA posters	3Q 2011
	Update General MoA Poster	3Q 2011
MoA Presentation	<ul> <li>Develop MoA presentation for general use in IRAC covering broad MoAs (IGR, vs. neural, vs. respiration) for use in MoA publications and presentations.</li> <li>Web-based then slide set</li> </ul>	4Q 2011
	Develop MoA diagrams (from above) for use in publications	4Q 2011



### Goals & SMART Objectives (for 2011/12)

Goals	Objectives	Timeline
E-classification	<ul> <li>Update e-classification on IRAC website as needed</li> </ul>	On-going
MoA reference list	<ul> <li>Establish as MoA reference (references for the different MoA Groups) – to be posted on the IRAC web-site</li> </ul>	3Q 2011
Resistance mechanisms presentation	<ul> <li>Develop a general presentation on resistance mechanisms involved with insecticide resistance</li> </ul>	4Q 2011