

Session 3

**International Working Group & Country Group Review
46th Meeting of IRAC International, Brussels, Belgium**

Wednesday - March 30th, 2011

Mode of Action WG

Tom Sparks



MoA Classification Objectives

- **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.**

■ 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)

■ 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 29th)

■ 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**



Insecticide Resistance Action Committee

Goals & SMART Objectives (for 2010/11)

Goals	Objectives	Timeline
Continue to review and update the MOA scheme as required.	<ul style="list-style-type: none">Update as needed the current Version 7.0 to include any changes and / or new actives.	In progress
Develop new versions of the MOA Structure Poster as needed	<ul style="list-style-type: none">Using the new version of the scheme (V7.0) update the MOA Structure posterWork with the C&E WG to print copies (v7.0) for distribution	Completed On hold
Develop non English versions of the MOA Structure Poster – with C&E WG	<ul style="list-style-type: none">Develop Portuguese-language version of the MoA Structure posterDevelop other language versions of the MoA structure poster	Completed Under discussion
Update other MOA posters	<ul style="list-style-type: none">Work with C&E Team to incorporate any updates from new versions of the MoA Scheme into Pest MOA postersUpdate General MoA Poster	In progress Completed
Develop MoA Diagrams.	<ul style="list-style-type: none">Provide MoA diagrams for the different broad MoAs (IGR, vs.. neural, vs. respiration) for use in MoA publications and presentations.	Still in progress



Insecticide Resistance Action Committee

Goals & SMART Objectives (for 2010/11)

Goals	Objectives	Timeline
Develop MoA WG presentation	<ul style="list-style-type: none">Develop a general MoA oral presentation that can be used at scientific meetings	In progress
Develop Resistance mechanisms Poster	<ul style="list-style-type: none">Develop a general poster on mechanisms of insecticide resistance	In progress

■ 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 - cyanthrilprole
- Group UN - pyrfluquinazon
- Group 6 - lepimectin

- other minor revisions

6.2. Classification Table

IRAC MoA Classification v 7.0, August 2010 ¹		
Main Group and Primary Site of Action	Chemical Sub-group or exemplifying Active Ingredient	Active Ingredients
1* Acetylcholinesterase (AChE) inhibitors Nerve action [Strong evidence that action at this protein is responsible for insecticidal effects] Please see footnotes for further information on the use of compounds between sub-groups	1A Carbamates	Alanycarb, Aldicarb, Bendiocarb, Benfuracarb, Butocarbinoxim, Butoxyacarbinoxim, Carbaryl, Carbosulfan, Carbosulfan, Ethiofencarb, Fenobucarb, Formetanate, Furathiocarb, Isoprocarb, Methiocarb, Methomyl, Metolcarb, Oxamyl, Pirimicarb, Propoxur, Thiodicarb, Thiofanox, Triazamate, Trimethacarb, XMC, Xyllocarb
	1B Organophosphates	Acephate, Azamethiphos, Azinphos-ethyl, Azinphos-methyl, Cadusafos, Chlorethoxyfos, Chlorfenvinphos, Chlormephos, Chlorpyrifos, Chlorpyrifos-methyl, Coumaphos, Cyanophos, Demeton-S-methyl, Diazinon, Dichlorvos/ DDVP, Dicrotophos, Dimethoate, Dimethylvinphos, Disulfoton, EPN, Etkinon, Ethiozaphos, Fampflur, Fenamiphos, Fenitrothion, Fenthion, Fosthiazate, Heptenophos, Imicyafos, Isofenphos, Isopropyl O-(methoxyaminothio-phosphoryl) salicylate, Isoxathion, Malathion, Mecarbam, Methamidophos, Methidathion, Mevinphos, Monocrotophos, Naled, Omethoate, Oxydemeton-methyl, Parathion, Parathion-methyl, Phenothoate, Phorate, Phosalone, Phosmet, Phosphamidon, Phoxim, Pirimiphos-methyl, Profenofos, Propetamphos, Prothiofos, Pyraclofos, Pyridaphenthion, Quinalphos, Sulfotep, Tebupirinfos, Temephos, Terbufos, Tetrachlorvinphos, Thiometon, Triazophos, Trichlorfon, Vamidothion
2 GABA-gated chloride channel antagonists Nerve action [Strong evidence that action at this protein is responsible for insecticidal effects]	2A Cycloidiene organochlorines	Chlordane, Endosulfan
	2B Phenylpyrazoles (Fiproles)	Ethiprole, Fipronil
3* Sodium channel modulators Nerve action [Strong evidence that action at this protein is responsible for insecticidal effects] Please see footnotes for further information on the use of compounds between sub-groups	3A Pyrethroids Pyrethrins	Acrinathrin, Allethrin, d-cis-trans Allethrin, d-trans Allethrin, Bifenthrin, Bioallethrin, Bioallethrin S-cyclopentenyl isomer, Bioremethrin, Cycloprothrin, Cyfluthrin, beta-Cyfluthrin, Cyhalothrin, lambda-Cyhalothrin, gamma-Cyhalothrin, Cypermethrin, alpha-Cypermethrin, beta-Cypermethrin, beta-cypermethrin, zeta-Cypermethrin, Cyphenothrin, (1R)-trans-isomers], Deltamethrin, Empenthrin, (EZ)- (1R)-isomers], Esfenvalerate, Etofenprox, Fenpropathrin, Fenvalerate, Flucythrinate, Flumethrin, tau-Fluvalinate, Halfenprox, Imiprothrin, Kadethrin, Permethrin, Phenothrin [(1R)-trans-isomer], Prallethrin, Pyrethrins (pyrethrum), Resmethrin, Sifluthrin, Tefluthrin, Tetramethrin, Tetramethrin [(1R)-isomers], Tralomethrin, Transfluthrin
	3B DDT Methoxychlor	DDT Methoxychlor

- **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

Grupo 1: Inibidores de Acetilcolinesterase (AChE) - Inibidores da acetilcolinesterase (AChE)

1A Carbamatos

1B Organofosforados

Grupo 2: Inibidores dos canais de cálcio regulados por voltagem (VGCC)

2A Clotolizina Organoclorados

2B Fenilpiridina (Fipronil)

Grupo 3: Moduladores dos canais de cálcio pouco regulados por voltagem (L-type)

3A Pirrolizidina Piretrinas

3B DDT, Metololol

Grupo 4: Agonistas dos receptores metabotrópicos de acetilcolina (mAChR)

4A Neonicotinóides

4B Nicotina

Grupo 5: Moduladores da atividade de receptores de acetilcolina (nAChR)

5 Spirotetras

Grupo 6: Inibidores do canal de cloro

6 Acetamidas, MBamidas

Grupo 7: Moduladores do hormônio juvenil

7A Análogos do Hormônio Juvenil

7B Fenoxiazóis

7C Pipropilfen

Classificação de Modo de Ação

IRAC

Comitê de Ação Resistência a Inseticidas

A Chave do Manejo de Resistência

Mais informações sobre o IRAC e a Classificação de Modo de Ação disponíveis no site: www.irac-online.org ou enquiries@irac-online.org

Grupo 8: Inibidores da síntese de quitina (inibidores da síntese)

8A Haletos alquila

8B Clomiprina

8C Fluoreto de sulfato

8D Sincal

8E Tártaro amílico

Grupo 9: Inibidores da síntese de quitina (inibidores da síntese)

9B Piretrinas

9C Fenilpiridina

Grupo 10: Inibidores de crescimento da larva

10A Clotetazina, Heftazur

10B Etoxazina

Grupo 11: Agonistas metabotrópicos e inibidores da síntese de acetilcolina (mAChR)

11A, 11B, 11C, 11D, 11E, 11F, 11G, 11H, 11I, 11J, 11K, 11L, 11M, 11N, 11O, 11P, 11Q, 11R, 11S, 11T, 11U, 11V, 11W, 11X, 11Y, 11Z

Grupo 12: Inibidores da síntese do RNA ribossômico

12A Difenilacetamidas

12B Acafóides Organoclorados

12C Propargila

12D Tereftalato

Grupo 13: Desacetilases de Fosforilase oxidativa de inibidores da síntese de glicogênio

13 Pirroles, Difeniloleno

Grupo 14: Desacetilases das acetilcolinas (inibidores da síntese de AChE)

14 Análogos de Fenilpiridina

Grupo 15: Inibidores de síntese de quitina (inibidores da síntese)

15 Benzodiazóis

Grupo 16: Inibidores de síntese de quitina (inibidores da síntese)

16 Spirotetras

Grupo 17: Agonistas dos receptores metabotrópicos de acetilcolina (mAChR)

17 Clomiprina

Grupo 18: Agonistas dos receptores metabotrópicos de acetilcolina (mAChR)

18 Spirotetras

Grupo 19: Agonistas dos receptores metabotrópicos de acetilcolina (mAChR)

19 Amitraz

Grupo 20: Inibidores do canal de cálcio regulado por voltagem (VGCC)

20A Hidrametilolol

20B Acetipolol

20C Fluoripirina

Grupo 21: Inibidores do canal de cálcio regulado por voltagem (VGCC)

21A METI acetamidas e inibidores

21B Rotenona

Grupo 22: Inibidores da síntese de RNA ribossômico (inibidores da síntese)

22A Indoxacarbe

22B Metilflufenazina

Grupo 23: Inibidores da síntese de RNA ribossômico (inibidores da síntese)

23 Difenilacetamidas

Grupo 24: Inibidores da síntese de RNA ribossômico (inibidores da síntese)

24A Fenitro

24B Clorfen

Grupo 25: Inibidores da síntese de RNA ribossômico (inibidores da síntese)

25 Clomiprina

Grupo 26: Inibidores da síntese de RNA ribossômico (inibidores da síntese)

26 Clotetazina

Grupo 27: Inibidores da síntese de RNA ribossômico (inibidores da síntese)

27A, 27B, 27C, 27D, 27E, 27F, 27G, 27H, 27I, 27J, 27K, 27L, 27M, 27N, 27O, 27P, 27Q, 27R, 27S, 27T, 27U, 27V, 27W, 27X, 27Y, 27Z

Observações:

- Representa classes químicas distintas que se dividem, mas o mesmo modo de ação.
- O mesmo número químico indica compostos que podem agir no mesmo modo de ação.
- Os subgrupos de inseticidas de forma que o grupo de inseticidas composto de vários inseticidas é usado de forma diferente para indicar que os inseticidas são usados de forma diferente.
- Inseticidas com propriedades de ação semelhantes, mas que não são de fato inseticidas, estão listados no site de ação de inseticidas de ação de inseticidas.
- Os inseticidas de ação de inseticidas de ação de inseticidas, incluindo o site de inseticidas em conjunto com inseticidas relacionados com inseticidas.

Observações:

- Os inseticidas metabotrópicos, podem incluir compostos de dois subgrupos distintos, desde que não tenham efeitos que a produção de pragas e um composto de inseticidas usado em dois modos de ação.
- Os inseticidas de ação metabotrópica, podem incluir compostos de dois subgrupos distintos, desde que não tenham efeitos que a produção de pragas e um composto de inseticidas usado em dois modos de ação.
- Os inseticidas de ação metabotrópica, podem incluir compostos de dois subgrupos distintos, desde que não tenham efeitos que a produção de pragas e um composto de inseticidas usado em dois modos de ação.

Observações:

- Os inseticidas de ação metabotrópica, podem incluir compostos de dois subgrupos distintos, desde que não tenham efeitos que a produção de pragas e um composto de inseticidas usado em dois modos de ação.
- Os inseticidas de ação metabotrópica, podem incluir compostos de dois subgrupos distintos, desde que não tenham efeitos que a produção de pragas e um composto de inseticidas usado em dois modos de ação.
- Os inseticidas de ação metabotrópica, podem incluir compostos de dois subgrupos distintos, desde que não tenham efeitos que a produção de pragas e um composto de inseticidas usado em dois modos de ação.

■ Presentations on IRAC MoA WG & MoA Scheme

– 29th 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





Insecticide Resistance Action Committee

Goals & SMART Objectives (for 2011/12)

Goals	Objectives	Timeline
Continue to review and update the MOA scheme as required.	<ul style="list-style-type: none"> 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 style="list-style-type: none"> Update MoA booklet (2nd ed) – incorporate changes in 7.1 	asap
Develop new versions of the MOA Structure Poster (with C&E WG) as needed	<ul style="list-style-type: none"> Using the new version of the scheme (V7.1) update the MOA Structure poster Work with the C&E WG to print copies (v7.1) for distribution Update current non-English versions Develop other language version of the MoA Structure poster (French, <i>Japanese</i>, <i>German</i>) 	2Q 2011 2-3Q 2011 3Q 2011 4Q 2011
Update other MOA posters	<ul style="list-style-type: none"> Work with C&E WG to incorporate updates from new versions of the MoA Scheme into Pest MoA posters Update General MoA Poster 	3Q 2011 3Q 2011
MoA Presentation	<ul style="list-style-type: none"> Develop MoA presentation for general use in IRAC covering broad MoAs (IGR, vs. neural, vs. respiration) for use in MoA publications and presentations. Web-based then slide set Develop MoA diagrams (from above) for use in publications 	4Q 2011 4Q 2011



Insecticide Resistance Action Committee

Goals & SMART Objectives (for 2011/12)

Goals	Objectives	Timeline
E-classification	<ul style="list-style-type: none">Update e-classification on IRAC website as needed	On-going
MoA reference list	<ul style="list-style-type: none">Establish as MoA reference (references for the different MoA Groups) – to be posted on the IRAC web-site	3Q 2011
Resistance mechanisms presentation	<ul style="list-style-type: none">Develop a general presentation on resistance mechanisms involved with insecticide resistance	4Q 2011