Session 3

47th Meeting of IRAC International,

Indianapolis, IN, USA

March 27-30st , 2012

Mode of Action WG

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Insecticide Resistance Action Committee

- Team Members 2011 / 2012
  - Nigel Armes - BASF
  - Shavesh Bhattarai - Chemtura
  - Georgina Bingham Zinanovic – Vestergaard Frandsen
  - Dan Cordova - DuPont
  - Fergus Earley - Syngenta
  - Peter Luemmen - Bayer
  - Danny Karmon - MAI
  - Shigeru Saito – Sumitomo
  - Ralf Nauen - Bayer
  - Vincent Salgado – BASF - Deputy
  - Tom Sparks – Dow - Chair
  - Jerry Watson – Dow
  - Alan Porter (IRAC)

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.

MoA Team Activities 2011/12

- Since 2011
  - Brussels (12 participants and several guests)
  - Four conference calls
    - May 20112 (7 participants)
    - July . 2010 (11 participants)
    - Nov. 2011 (8 participants & 1 guest)
    - Jan. 2012 (10 participants)
  - This week - face-to-face meeting
    - Session 2A (Indianapolis, March 28th)
- Company participation has been relatively constant for the past 4 years - eight (8) companies
  - BASF, Bayer, Dow, DuPont, Makhteshim-Agan, Sumitomo, Syngenta, Vestergaard Frandsen

Stats for MoA WG - 2011

- MoA Team page = 9484 page views
  - (3rd most popular page - 1st = home, 2nd = Resources)
- MoA Classification = 3986 (Most popular download)
- MoA Posters
  - MoA General = 296
  - MoA Leps = 301
  - MoA Sucking Pest = 295
  - MoA Acaricides = 278
  - MoA Mosquito = 337
  - Structures (English) = 618
  - Structures (Chinese) = 62
  - Structures (Portuguese) = 89
  - Structures (Spanish) = 820 (Most popular poster download)
- MoA Booklet = 268

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MoA Team Activities 2011/12

- **Updated MoA Scheme**
  - Feb. 2012 (version 7.2)
    - addition of new compounds to some groups
      - Group 4C- sulfoxaflor
      - Group 6 - lepimectin
      - Group 25 - cyflumetofen
      - Group 28 - cyantriliprole
      - Group UN - pyrifluquinazon
    - Worked with companies to discuss proper placement
    - Updated Group 11 (Bts)
      - In cooperation with Biotech
      - (lots of discussion / versions)
    - other minor revisions of wording

6.2. Classification Table

IRAC MoA Classification v 7.2, February 2012[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, Butocarboxim, Butoxycarboxim, Carbaryl, Carbofuran, Carbosulfan, Ethiofencarb, Fenobucarb, Formetanate, Furathiocarb, Isoprocarb, Methiocarb, Methomyl, Metolcarb, Oxamyl, Pirimicarb, Propoxur, Thiodicarb, Thiofanox, Triazamate,Trimethacarb, XMC, Xylylcarb
	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, Ethion, Ethoprophos, Famphur, 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, Phenthoate, Phorate, Phosalone, Phosmet, Phosphamidon, Phoxim, Pirimiphos- methyl, Profenofos, Propetamphos, Prothiofos, Pyraclofos, Pyridaphenthion, Quinalphos, Sulfotep, Tebupirimfos, 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 Cyclodiene 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 , Bioresmethrin, Cycloprothrin, Cyfluthrin, *beta*-Cyfluthrin, Cyhalothrin, *lambda*-Cyhalothrin, *gamma*-Cyhalothrin, Cypermethrin, *alpha*-Cypermethrin, *beta*-Cypermethrin, *theta*-cypermethrin, *zeta*-Cypermethrin, Cyphenothrin , (1*R*)-*trans*- isomers], Deltamethrin, Empenthrin (*EZ*)- (1*R*)-isomers], Esfenvalerate, Etofenprox, Fenpropathrin, Fenvalerate, Flucythrinate, Flumethrin, *tau*-Fluvalinate, Halfenprox, Imiprothrin, Kadethrin, Permethrin, Phenothrin [(1*R*)-*trans*- isomer], Prallethrin, Pyrethrins (pyrethrum), Resmethrin, Silafluofen, Tefluthrin, Tetramethrin, Tetramethrin [(1*R*)-isomers], Tralomethrin, Transfluthrin,
	3B DDT Methoxychlor	DDT Methoxychlor

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MoA Team Activities 2011/12

- **Updated MoA Structure Poster (New v7.2)**
  - minor revisions of some wording - Clean-up of some structures
  - Revised color scheme
  - Newest additions / changes
    - Addition of sulfoxaflor – 4C
    - Updated - Group 11
- **Next version – when needed**
- **MoA Structure Poster Translations (update to 7.2)**
  - Portuguese – update in progress
  - Japanese – New - completed
  - Spanish – Updated
  - Chinese – update in progress
  - French – New – in progress
  - Other languages – as needed

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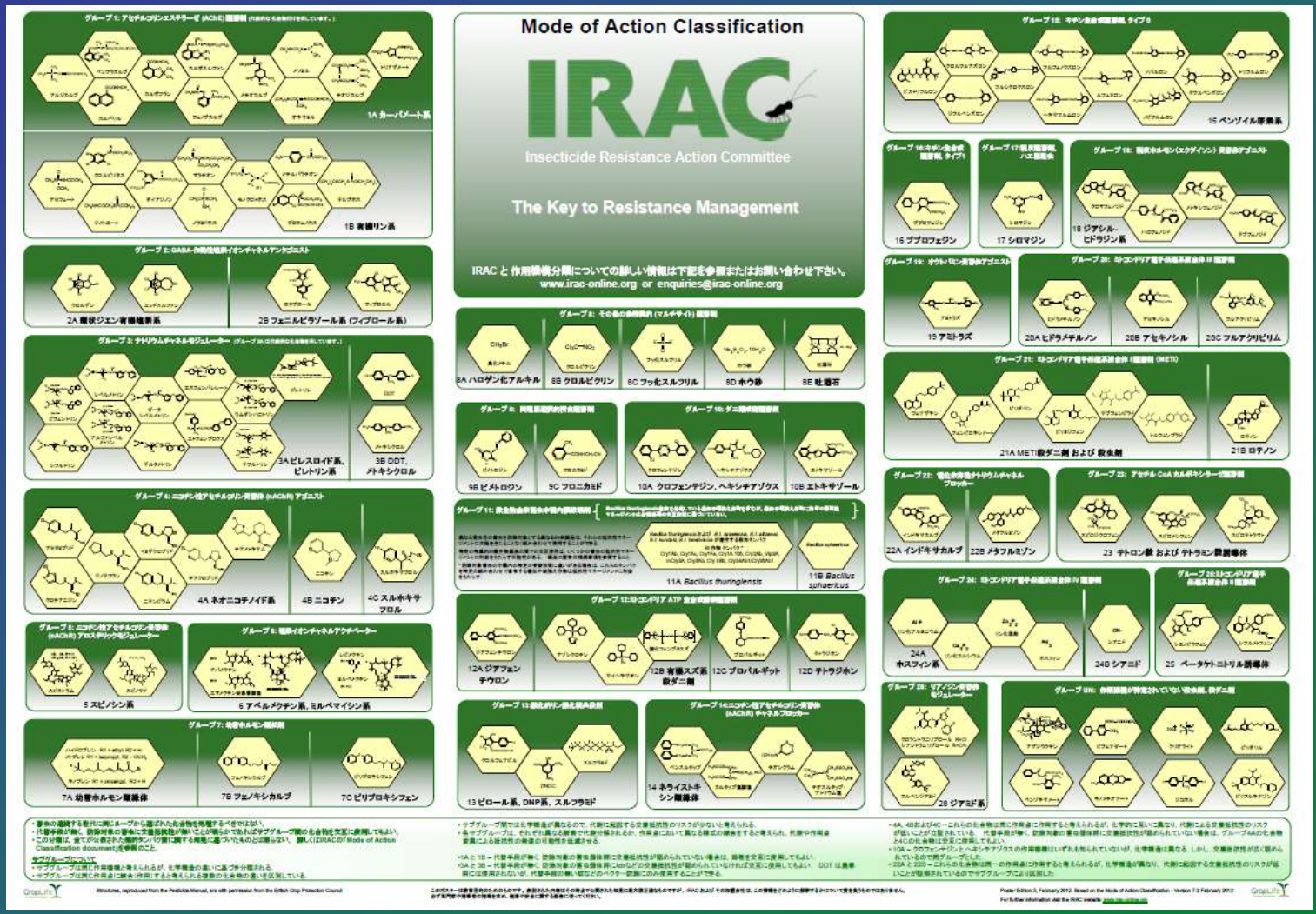
MoA Team Activities 2011/12



Japanese Version of MoA Structure Poster

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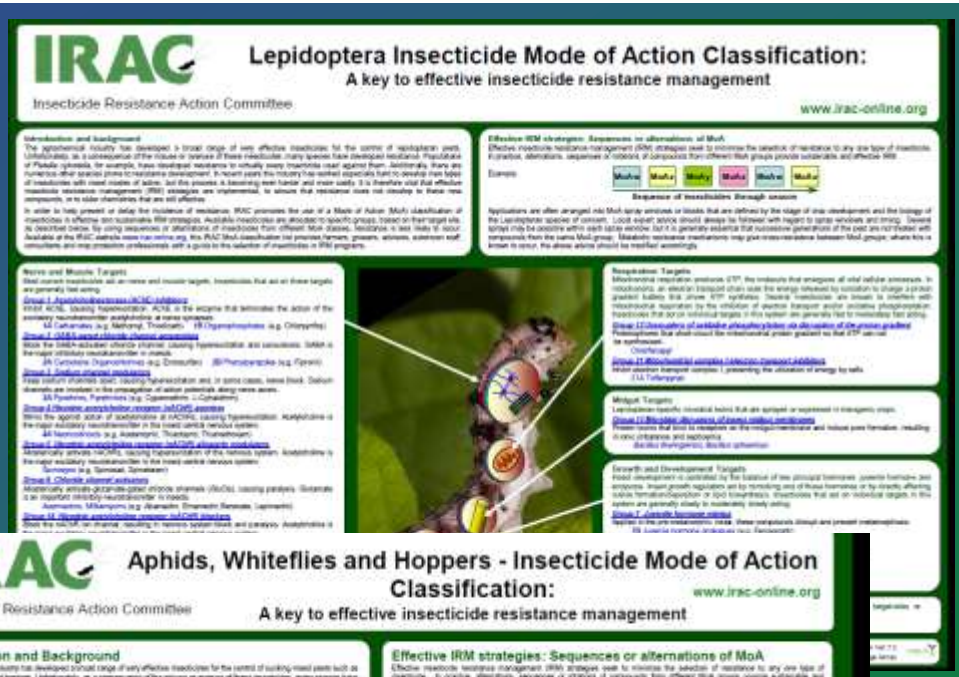
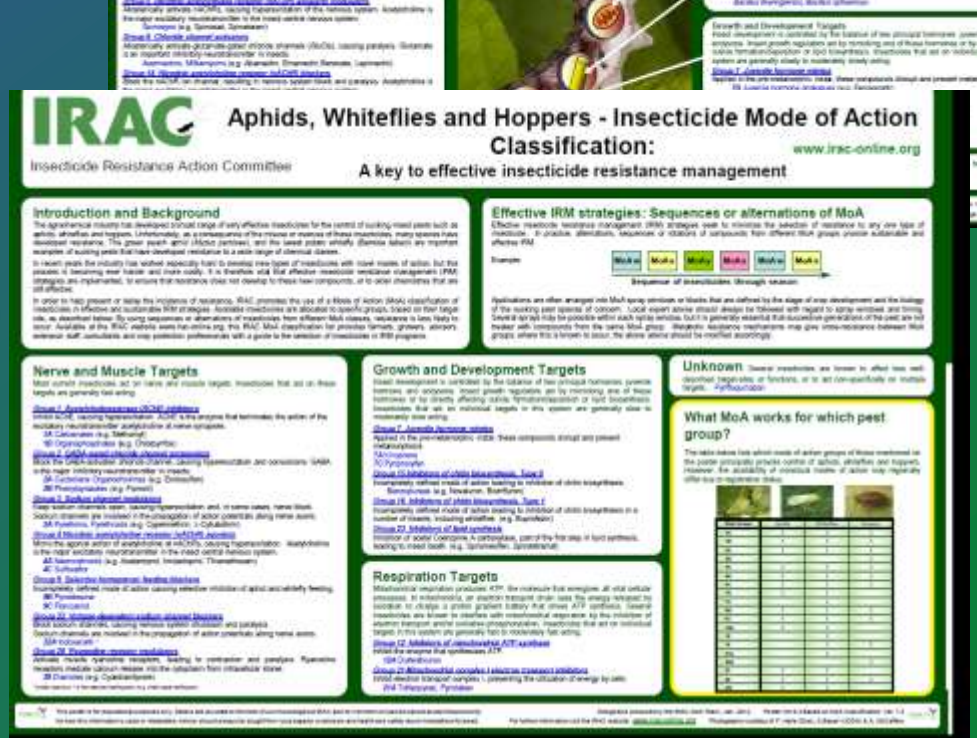
MoA Team Activities 2011/12

- Pest Group MoA Posters
- Updates completed
  - Lepidoptera
  - Sucking Insects
  - Mites
  - Mosquitoes
  - General MoA poster
- Next versions
  - Resistance Mechanisms
  - Updates on current posters as needed





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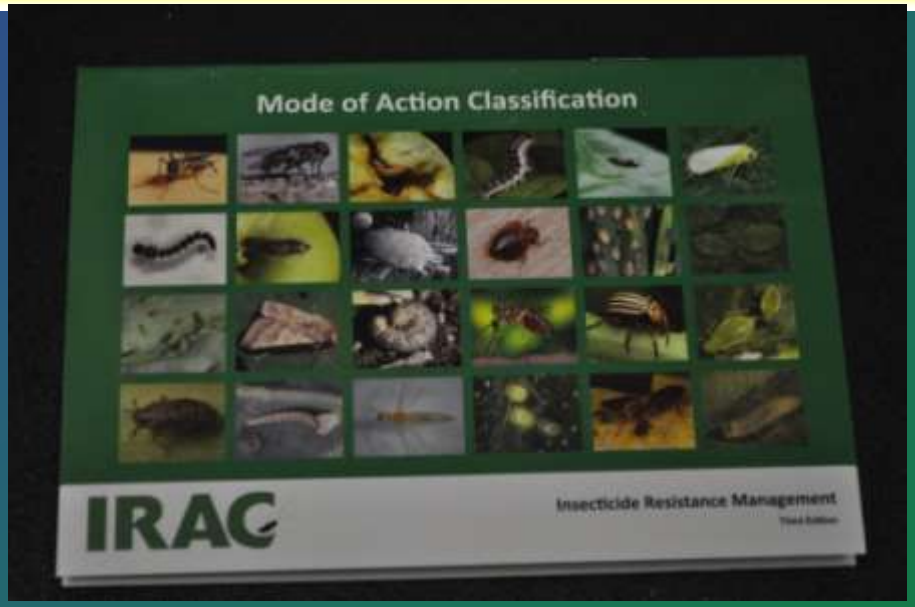
MoA Team Activities 2011/12

- MoA Booklet – 3rd edition just completed
  - pocket sized
  - Updated information
    - MoA classification
    - aspects from Pest group MoA posters
    - alphabetical listing of ai's with MoA classification
  - 2011/12 >4500 copies distributed
  - A Spanish version being considered



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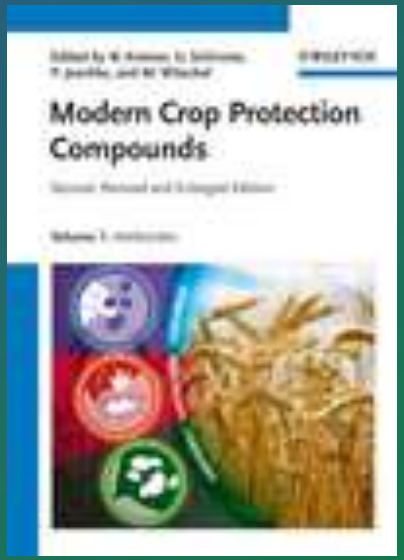
MoA Team Activities 2011/12

- **Book chapter – Published Jan. 2012**
  - Nauen R. Elbert A. McCaffery A. Slater R. Sparks TC. 2012. IRAC, insecticide resistance and mode of action classification of insecticides. In. *Modern Crop Protection Compounds*. Vol. 3, 2nd ed. (W. Kramer, U. Schirmer, P. Jeschke, M. Witschel, eds.), Wiley-VCH, New York, pp. 935-955.



- **Materials / presentations on IRAC MoA & MoA Scheme**
  - IRM Training Sessions - Philippines - 2011
  - Resistance 2011, Rothamsted
  - EPPO – Morocco - 2011
  - Entomological Society of America - Reno NV, Nov. 2011
    - Oral Presentation – T. Sparks
  - Japanese Society of Applied Entomology and Zoology - 2012

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Goals & SMART Objectives
(for 2012/13)

Goals	Objectives	Timeline
Continue to review and update the MOA scheme as required.	• Update as needed the current Version 7.2 to include any changes and / or new actives.	1Q 2012 √
Develop new versions of the MOA Structure Poster as needed	• Using the new version of the scheme (V7.2) update the MOA Structure poster • Work with the C&E WG to print copies (v7.2) for distribution	1Q 2012 √ 1Q 2012 √
Continue to review & update MoA Booklet	• Update MoA booklet (3nr ed)	1Q 2012 √
Develop non English versions of the MOA Structure Poster – with C&E WG	• Develop / update other language versions of the MoA Structure poster	1Q-2Q 2012
Update other MOA posters	• Work with C&E Team to incorporate any updates from new versions of the MoA Scheme into Pest MOA posters • Update General MoA Poster	1Q 2012 √ 2Q 2012 √
Develop MoA Diagrams.	• Provide MoA diagrams for the different broad MoAs (IGR, vs. neural, vs. respiration) for use in MoA publications and presentations – ***based on UNL output***	4Q 2012

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Goals & SMART Objectives
(for 2012/13)

Goals	Objectives	Timeline
Develop MoA WG presentation	• Develop a general MoA oral presentation that can be used at scientific meetings – *dependent on UNL output*	4Q 2012
MoA page – IRAC Website	• Update e-classification on IRAC website • Update MoA WG page – more interactive	2Q 2012 3Q 2012
Develop Resistance mechanisms Poster	• Develop a general poster on mechanisms of insecticide resistance	4Q 2012
Provide additional information on topics important to IRM	• Listing of target-site mutations • Listing of key references for each MoA group	3Q 2012 3Q 2012