

Session 3

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

Wednesday - March 30th, 2011

MSU Resistance Database

Gary Thompson



The Arthropod Pesticide Resistance Database

46th Meeting of IRAC International - Brussels
March 29th – March 31, 2011

MSU Resistance DB WG

<http://pesticideresistance.org>

Or www.irc-online.org (Teams or About:partners)

- **Team Leader & MSU Liaison: Gary Thompson**

- **U.S. Leads: David Rogers, Caydee Savinelli, John Imaraju, & Dan Vincent**
 - - Reviewed by full team
 - - 3 University Experts Reviews Scheduled

- **EU Team: Chris Longhurst, Ralf Nauen, Philippe Camblin, Russell Slater, & Tessa Knox**
 - - Opportunity for broader review
 - - Need Peer review by non-Industry experts

- **Brazil: Odeni Fernandez**



Global Insect Resistance

Insecticide Resistance Action Committee

2011 Insect Resistance Database Report

<http://www.pesticideresistance.org/>

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Picture UC



Picture Williams

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Center for Integrated Plant Systems
Michigan State University



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Acknowledgements

- This project was made possible by funds from the U.S. Department of Agriculture Cooperative State Research, Education, and Extension Services (USDA CSREES) and the Insecticide Resistance Action Committee; and supported by the Michigan State University Department of Entomology and Project GREEN
- Additionally, we would like to thank:
 - Lee Duynslager
 - Qiang Xue Harrison
 - Oscar Castaneda
 - Paul Glasser
 - Brittany

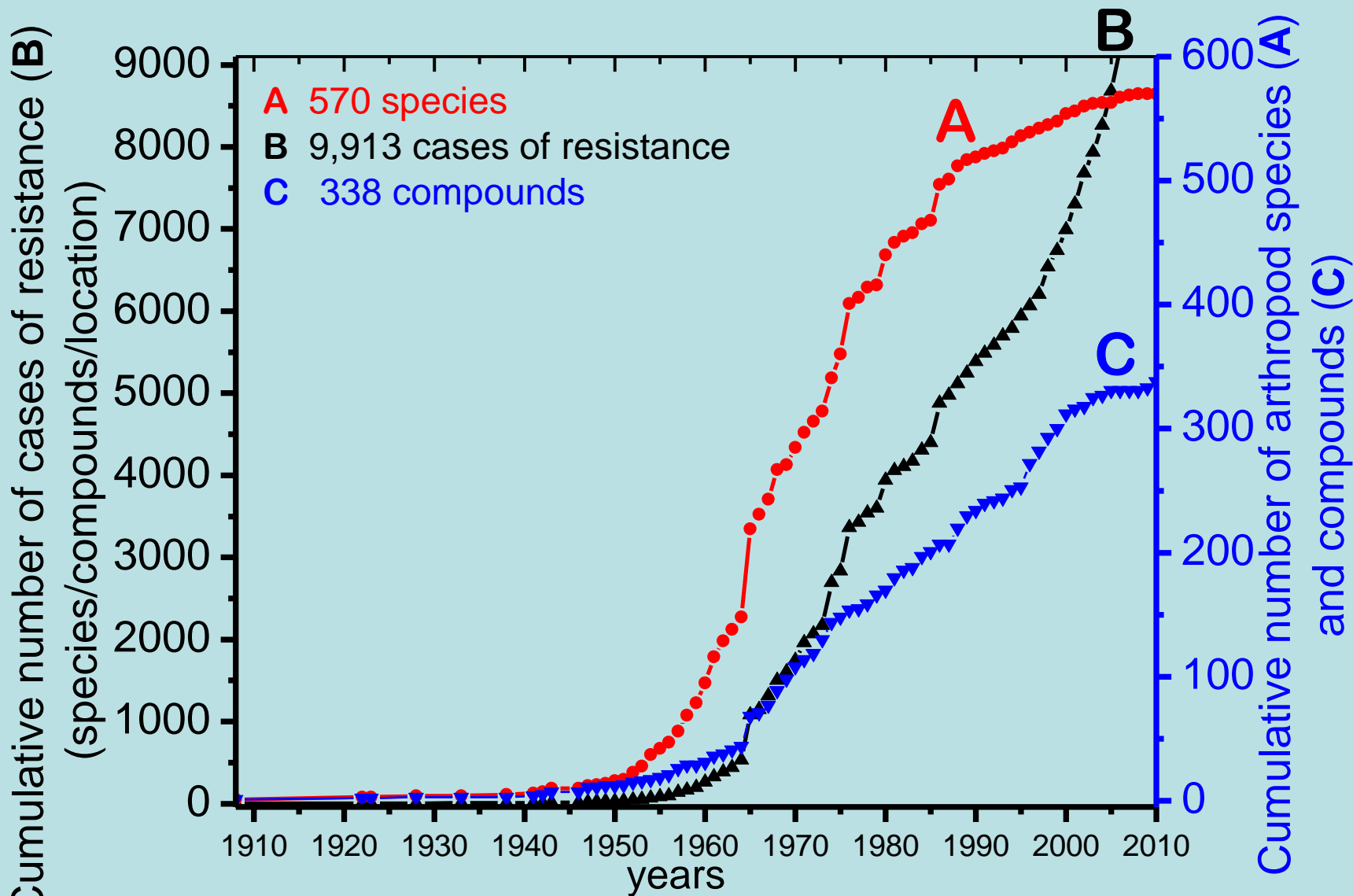


Fig 1. Evolution of arthropod insecticide resistance from 1908 to 2011. (species, compounds and total number of cases).

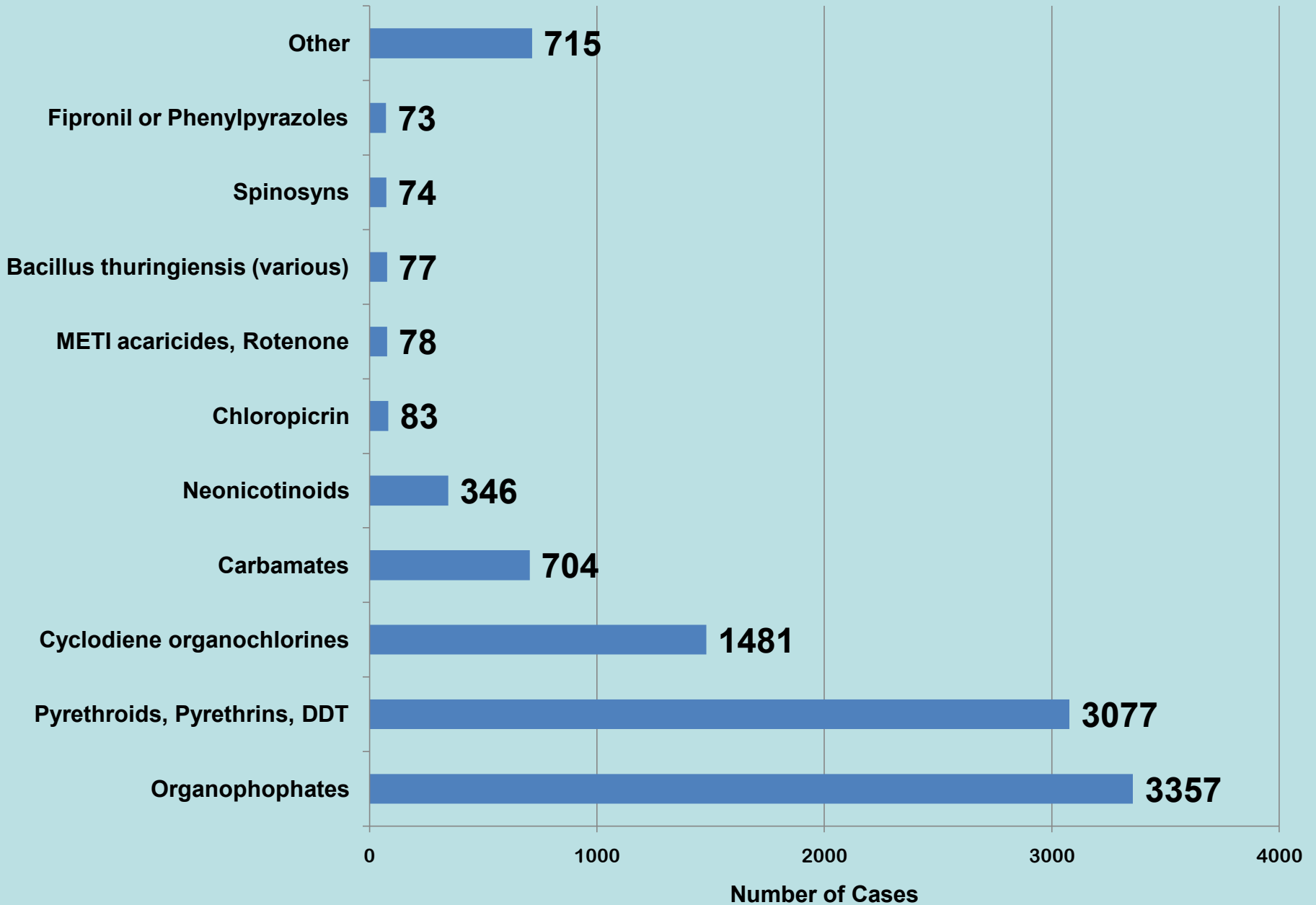
Top 10 Resistant Species (based on number of a.i.'s resistant to)



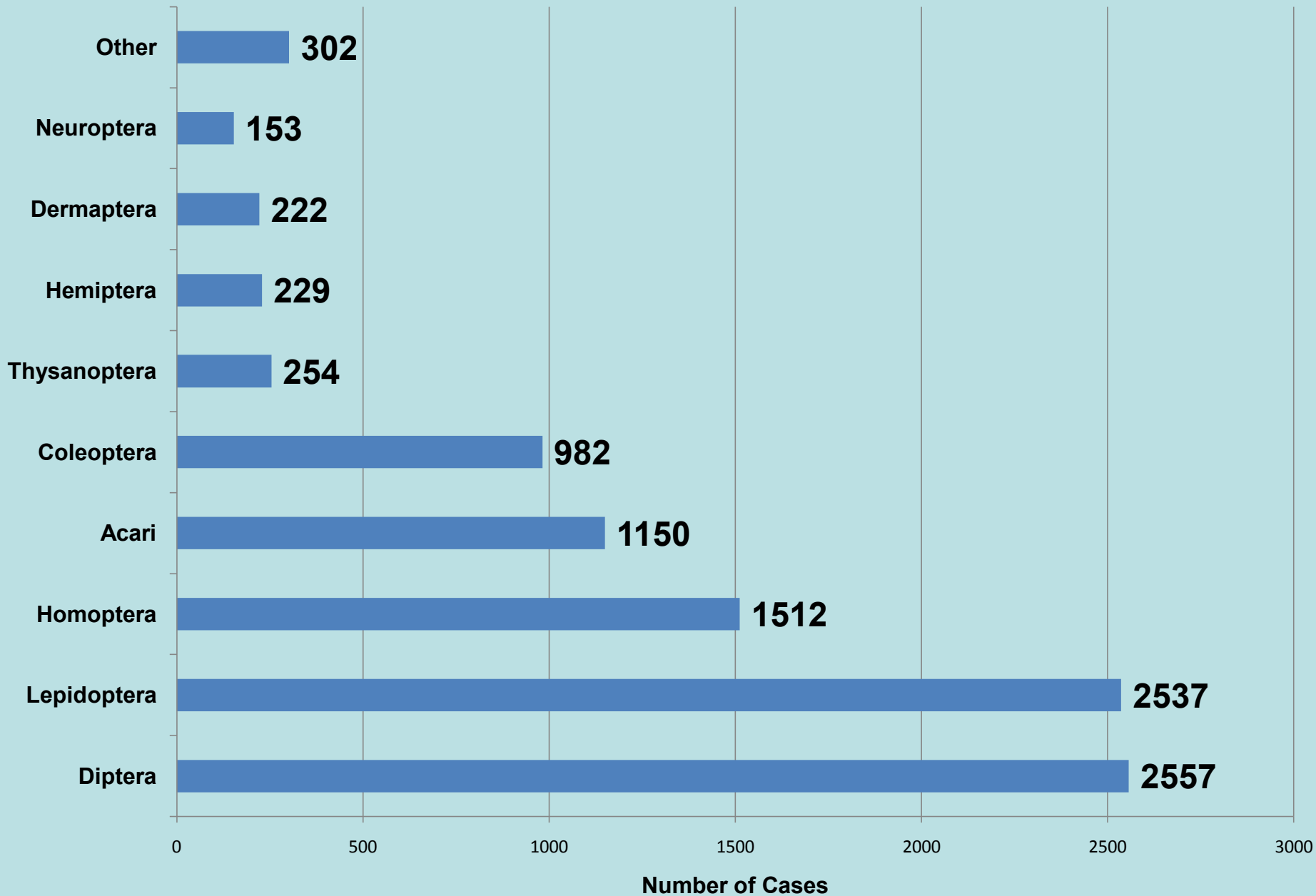
11-20 Resistant Species (based on number of a.i.'s resistant to)



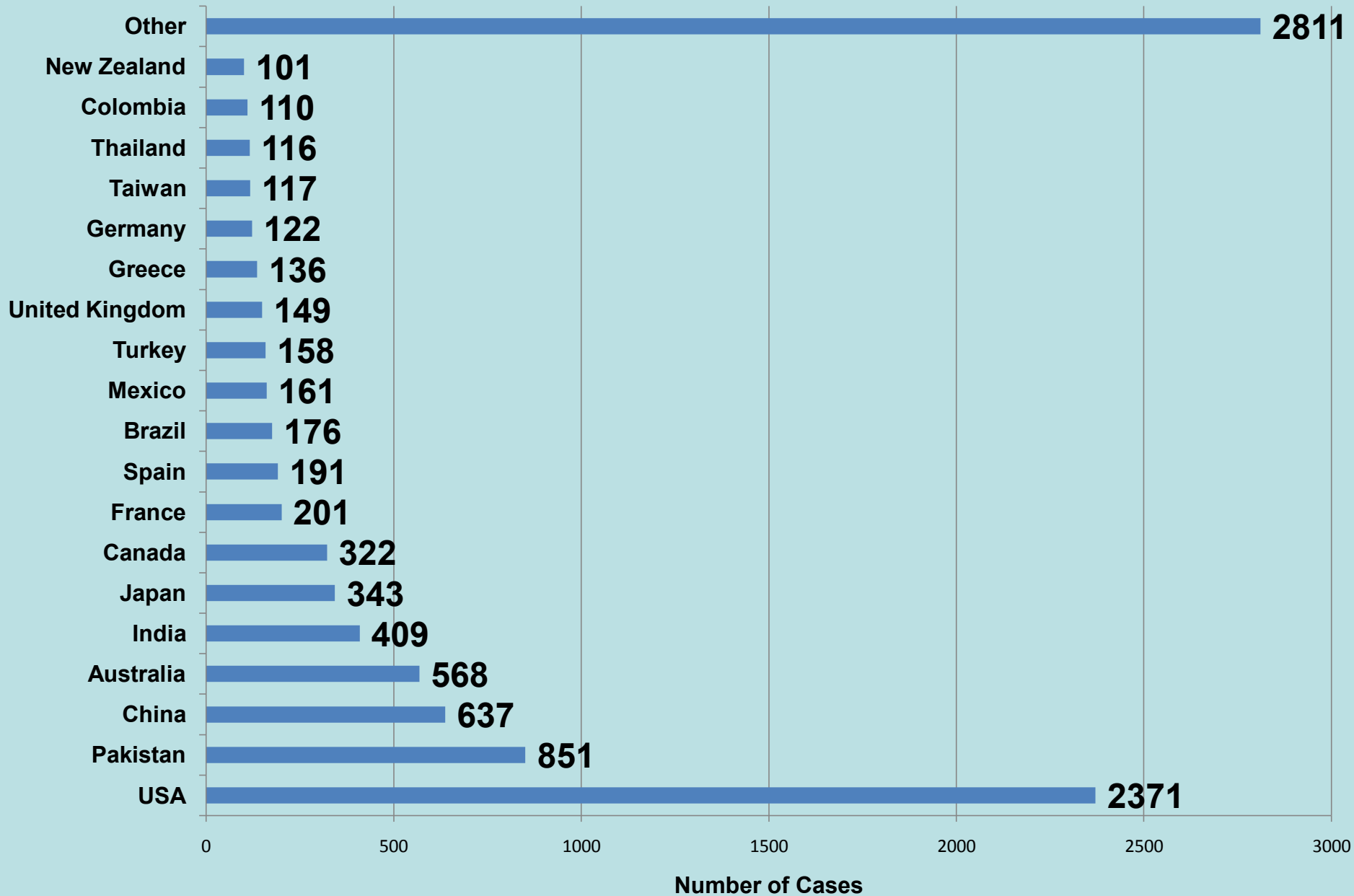
Frequency of Cases by Mode of Action



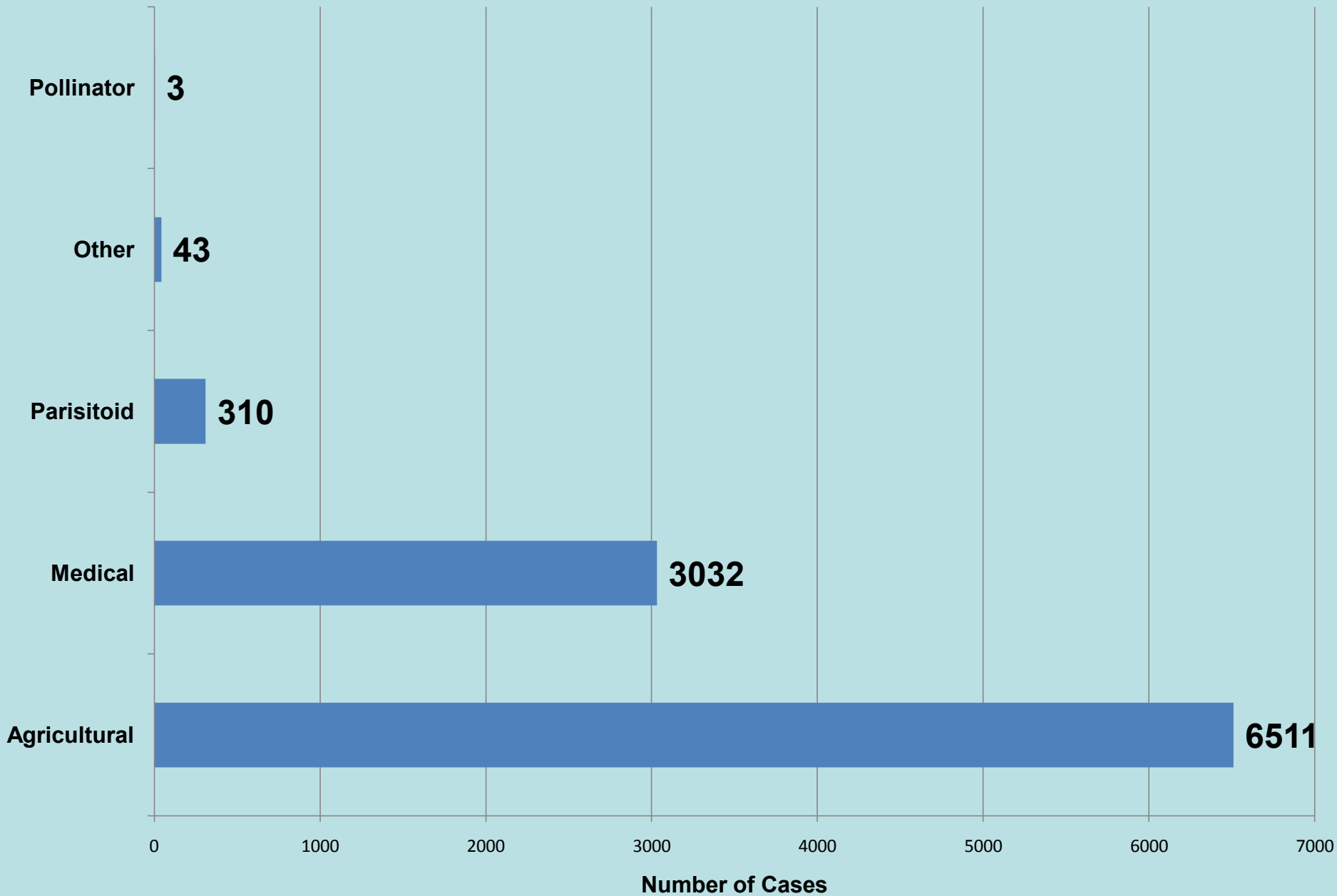
Frequency of Cases by Arthropod Order



Frequency of Cases by Country



Frequency of Cases by Category



Submitting to APRD: Arthropod and Mode of Action

 **Arthropod Pesticide Resistance Database**
Irac Aprd, IRAC Database, CHIEF EDITOR

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• Arthropod & Pesticide • Population & Location • Site & Bioassay • Resistance Level • Reference • CR • Summary

Case Submission :: Arthropod & Pesticide

Arthropod Classification

Arthropod	leptinotarsa decemlineata	*	?
Other Known Name(s)	colorado potato beetle		
Order	coleoptera		
Family	chrysomelidae		
Class	insecta		

Mode Of Actions (MOA)

MOA 1	4A: Neonicotinoids; Nicotinic Acetylcholine receptor agonists / antagonists	*
MOA 2	-- Select --	
MOA 3	-- Select --	

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Submitting to APRD: Geographic Location

Geographic Location

Country	USA <input type="text"/> *
State or Province <i>(no abbreviations)</i>	Michigan <input type="text"/>
County, Prefecture, or Nearest City	East Lansing <input type="text"/>
Site	field <input type="text"/>
Area Code <i>(postal or telephone)</i>	517 <input type="text"/>
Description of the Area	<input type="text" value="southwest corner of farm"/>
Coordinates <i>(for global positioning system)</i>	Latitude degrees: <input type="text" value="42"/> minutes: <input type="text" value="44"/> seconds: <input type="text" value="5.28"/> direction: <input checked="" type="radio"/> North <input type="radio"/> South Longitude degrees: <input type="text" value="84"/> minutes: <input type="text" value="28"/> seconds: <input type="text" value="50.88"/> direction: <input type="radio"/> East <input checked="" type="radio"/> West

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Submitting to APRD: Status, Impact, and Comments on Resistance

Status of the Resistance Medium ▾

Impact of the Resistance High ▾ *

Comments*(optional)*

(e.g., economic loss figures)

severe pest that causes \$13 million in damage annually.


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Submitting to APRD: Referencing Information



Arthropod Pesticide Resistance Database
Irac Aprd, IRAC Database, CHIEF EDITOR

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• Arthropod & Pesticide • Population & Location • Site & Bioassay • Resistance Level • **Reference** • CR • Summary

Case Submission :: Reference

Type	Published *
Title	Resistance of Colorado Potato Beetle to <u>Neonicotin</u>
Author	Hudson, I.T. (e.g., Xue, Q., Green, J. C., and White, T.)
Journal (no abbreviations)	Journal of Economic Entomology
Volume	56
Pages	126-128 (e.g., 12-23)
Year	2009 *
Url	
Attach E-document (e.g., pdf, doc)	Choose File no file selected
Comments	

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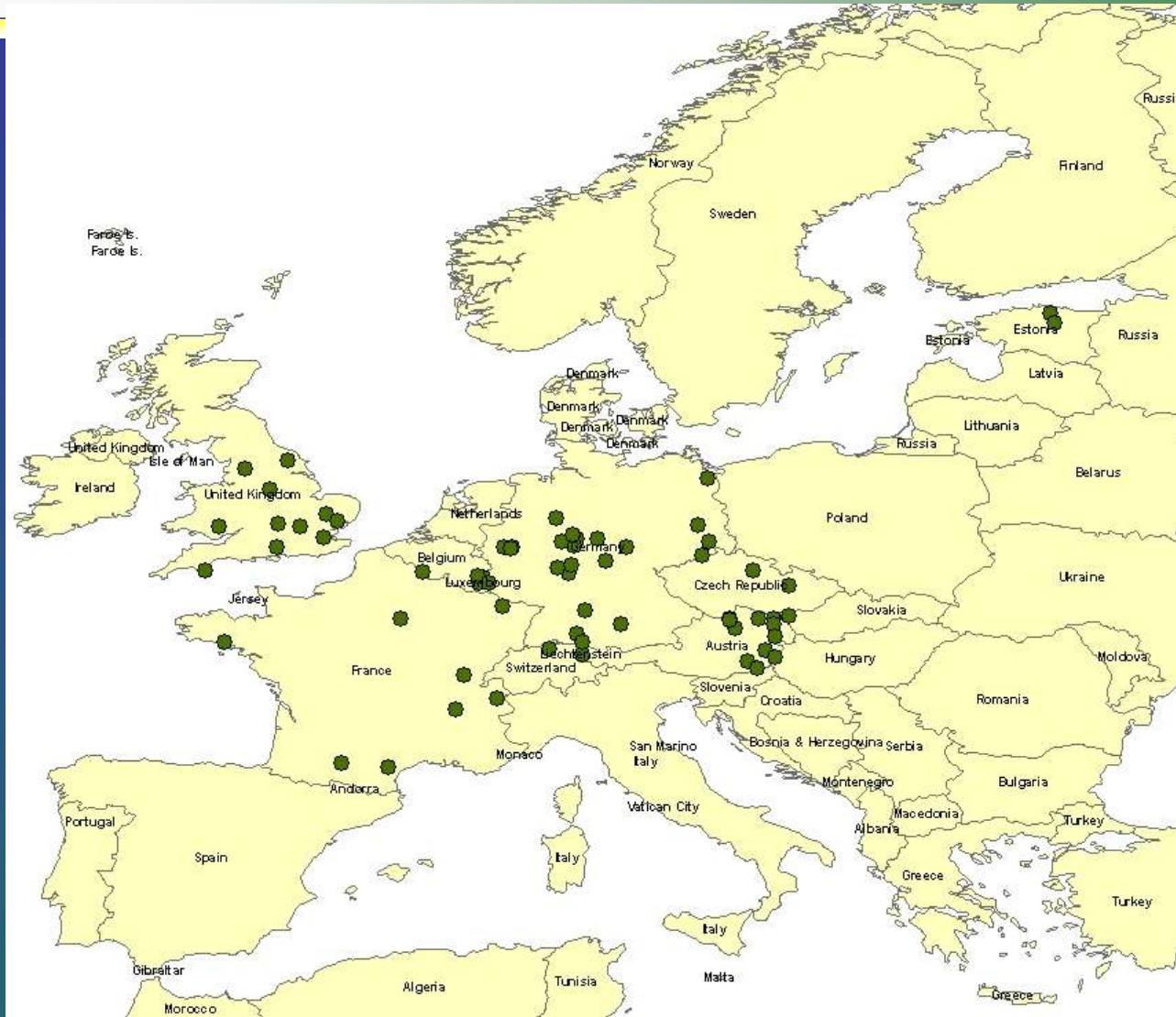
- **Nearly every case of resistance in the APRD is associated with some form of geographic location: city, county, state, province, country, etc, although geographic coordinates are ideal because they are the most accurate.**
- **Currently, we are working on creating GIS maps with IRAC data of pesticide resistance in the European Pollen Beetle.**

European Pollen Beetle Resistance



Locations where EPB is highly susceptible to insecticides

European Pollen Beetle Resistance



Locations where EPB is susceptible to insecticides

European Pollen Beetle Resistance



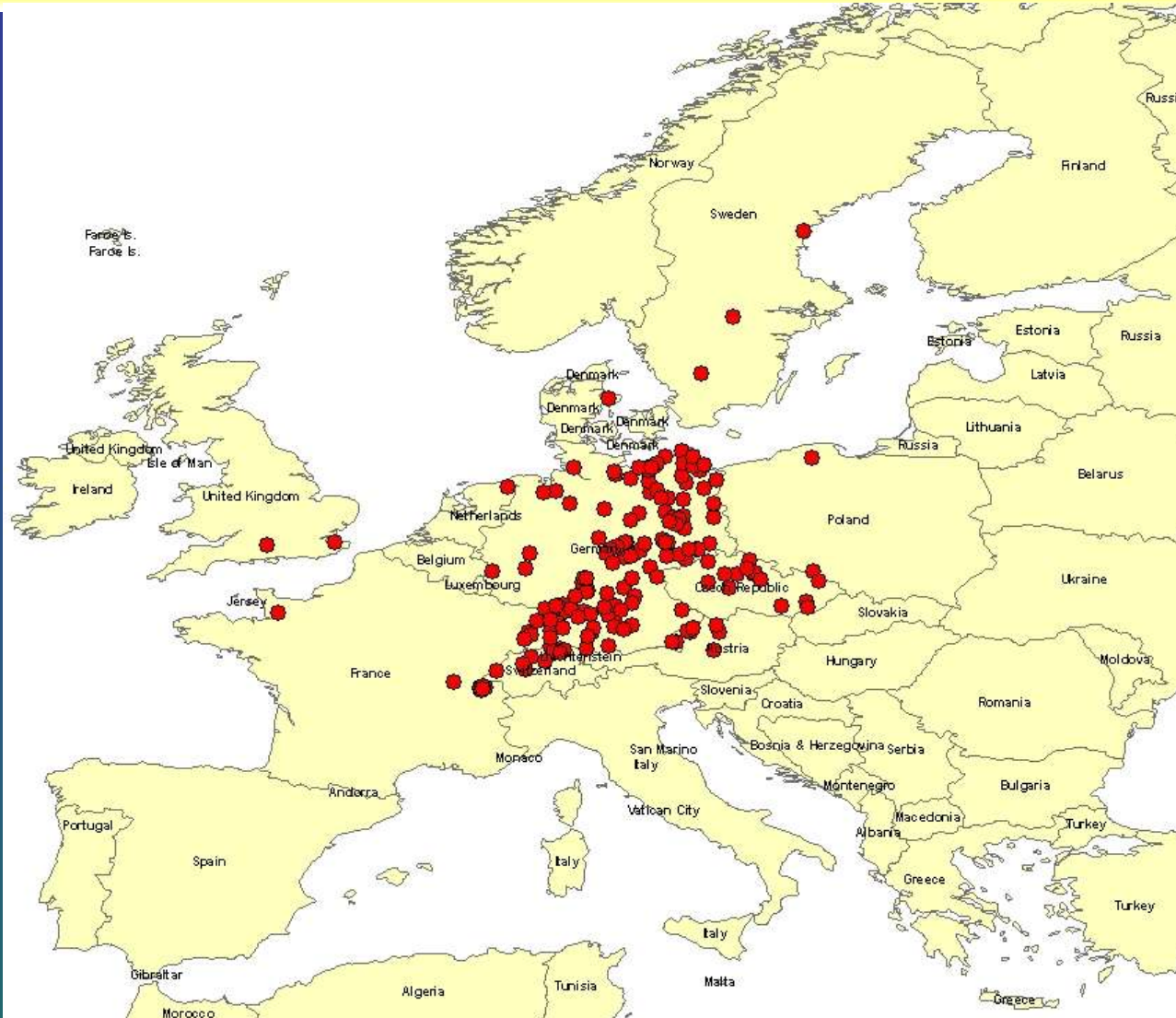
Locations where EPB is moderately resistant to insecticides

European Pollen Beetle Resistance



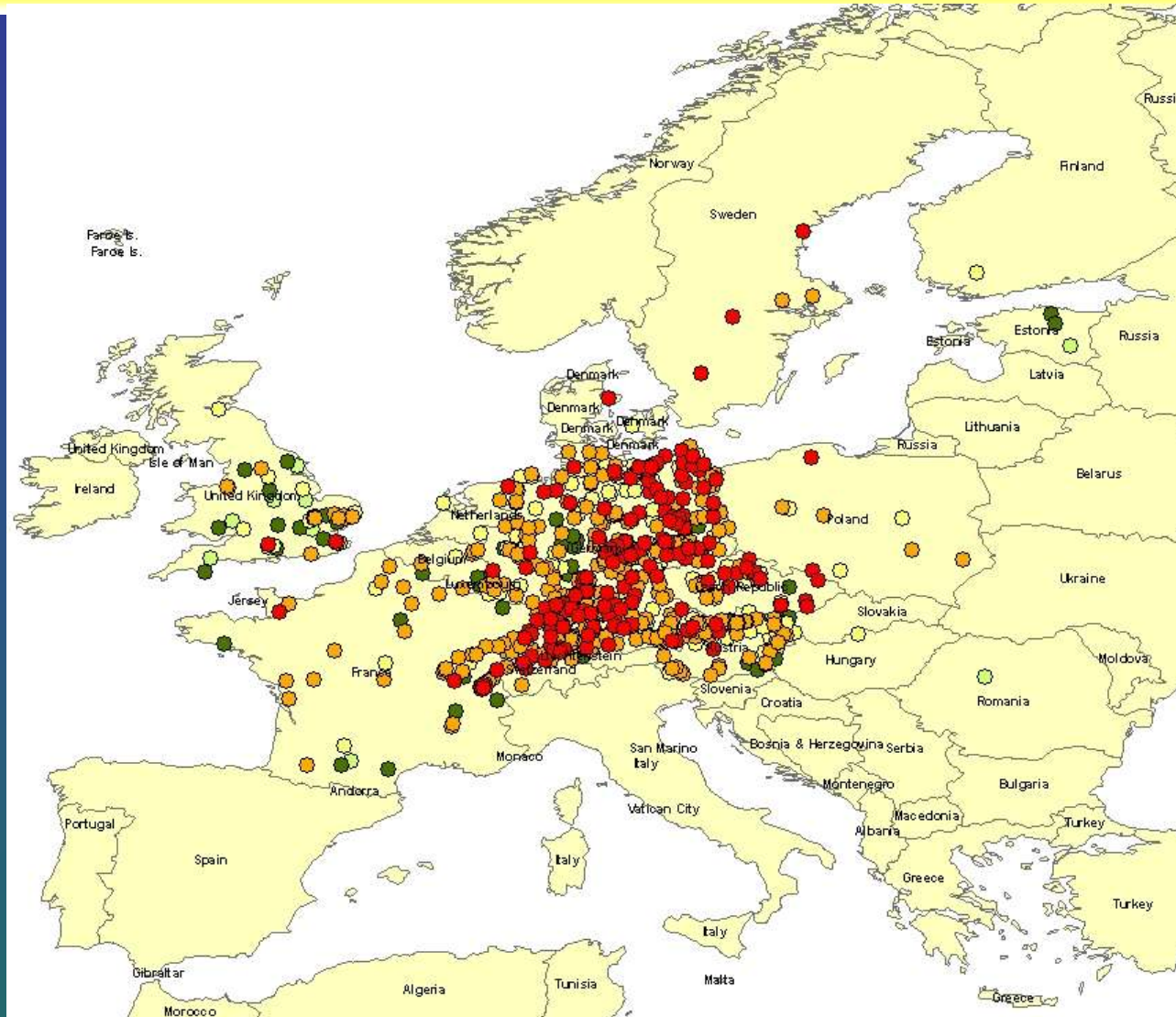
Locations where EPB is resistant to insecticides

European Pollen Beetle Resistance



Locations where EPB is highly resistant to insecticides

European Pollen Beetle Resistance



Composite of all levels of EPB resistance to insecticides

Fig. 2. Usage of the Arthropod Resistance Database for 2010

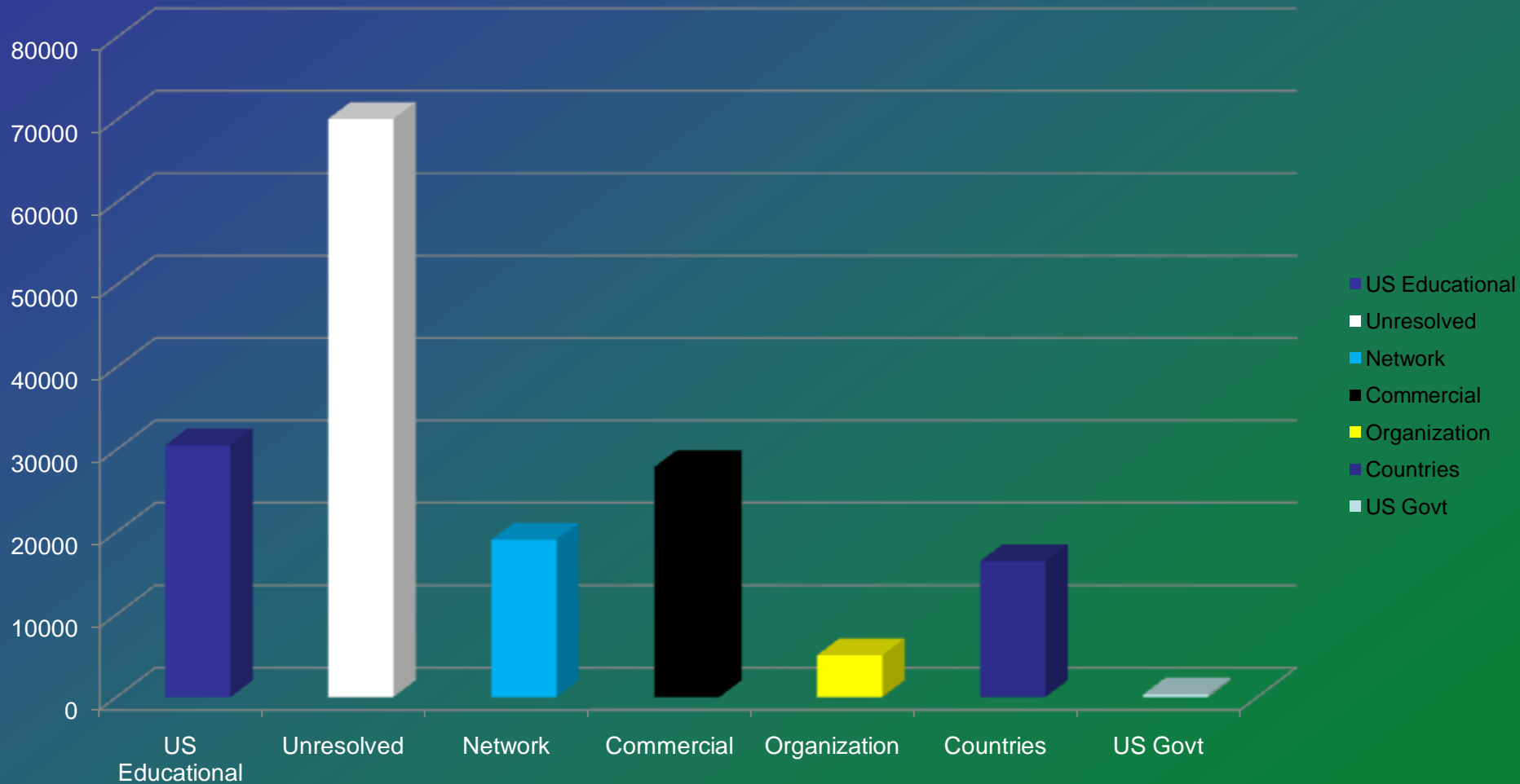
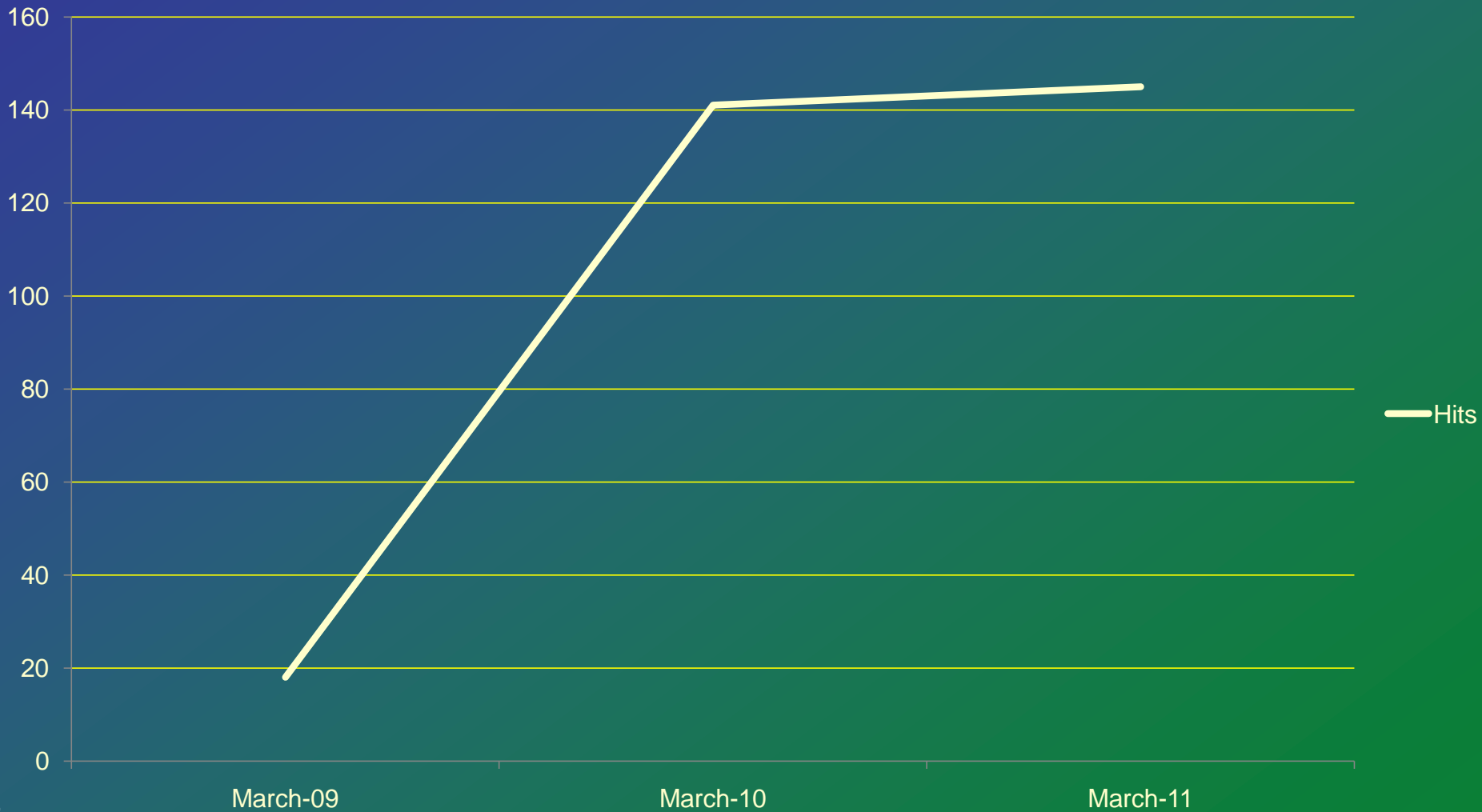


Fig. 1. Annual Hits x1000 to the Arthropod Pesticide Resistance Database From 2009 to 2011





Insecticide Resistance Action Committee

Current state of database

- Annual literature surveys
- Online case submission system
- IRAC Expert Survey
 - Excel file reporting system
 - Currently contains records from the United States for 2006-09, the EU for 2007-09, Brazil 08-09, and Africa mosquitoes for 2009.
 - Contains IRAC disclaimers and definitions
 - Must be simple and high level to be manageable



Insecticide Resistance Action Committee

Year of Survey	Country	Genus	Species	IRAC #	Resistance Status	Resistance Impact	Database Comments	Crop	Who Updated - Internal IRAC Only	Internal Comments for IRAC Users ONLY
2009	Austria	Leptinotarsa	dececlineata	3A	Medium	Medium		Potato	Nauen	Pyrethroids
2009	Austria	Meligethes	aeneus	3A	Medium	Medium	65% Resistant in 2009	Oil Seed Rape	Slater	Pyrethroids
2009	Czech Republic	Meligethes	aeneus	3A	High	Medium	96% Resistant in 2009	Oil Seed Rape	Slater	Pyrethroids
2009	Denmark	Meligethes	aeneus	3A	High	High	100% Resistant in 2009	Oil Seed Rape	Slater	Pyrethroids
2009	France	Cydia	pomonella	1B	Medium	Low		Pome Fruit	Longhurst	some Ops
2009	France	Meligethes	aeneus	3A	High	Medium	88% Resistant in 2009	Oil Seed Rape	Slater	Pyrethroids
2009	France	Myzus	persicae	1A	Medium	Medium		Various	Longhurst	OP
2009	France	Myzus	persicae	1B	Medium	Medium		Various	Longhurst	Carbamates
2009	France	Myzus	persicae	4A	Medium	Medium		Peach	Slater	Neonicotinoids
2009	France	Myzus	persicae	3A	Medium	Medium		Various	Longhurst	Pyrethroids
2009	France	Lobesia	botrana	1B	Medium	Medium		Grape	BASF	OP
2009	France	Leptinotarsa	dececlineata	1B	Medium	Medium		Potato	BASF	OP
2009	France	Panonychus	ulmi	21	Low	Low		Apple	Longhurst	METI acaricides
2009	Germany	Aphis	frangulae	3A	Medium	Medium		Potato	Nauen	Pyrethroids
2009	Germany	Aphis	gossypii	1A	Medium	Medium		Potato	Nauen	Pirimicarb
2009	Germany	Cydia	pomonella		Low	Low	grVirus	Apple	Nauen	grVirus
2009	Germany	Frankliniella	occidentalis	5	Medium	High		Vegetables/Ornamentals	Nauen	Spinosad
2009	Germany	Leptinotarsa	dececlineata	3A	Medium	Low		Potato	Nauen	Pyrethroids
2009	Germany	Meligethes	aeneus	3A	High	Medium	89% resistant in 2009	Oil Seed Rape	Slater	Pyrethroids
2009	Germany	Myzus	persicae	3A	Medium	Low		Vegetables	Nauen	Pyrethroids
2009	Germany	Panonychus	ulmi	21	Medium	Low		Apple	Nauen	METI acaricides
2009	Germany	Phorodon	humuli	4A	Low	Low		Hops	Nauen	Imidacloprid
2009	Germany	Tetranychus	urticae	6	Low	Low		Vegetables/ornamentals	Nauen	Abamectin
2009	Germany	Tetranychus	urticae	21	Medium	Medium		Hops	Nauen	METI acaricides
	Germany	Psylliodes	chrysocephala	3A	Low	Low		Oil Seed Rape	Slater	Pyrethroids
	Germany	Trialeurodes	vaporariorum	9B	Low	Low		Vegetables/Ornamentals	Slater	Pymetrozine
2009	Germany	Trialeurodes	vaporariorum	4A	Medium	Medium		Vegetables/Ornamentals	Nauen	Neonicotinoids
2009	Greece	Bactrocera	oleae	1B	Low	Low		Olive	AB, 11th Greek Entomology Congress	dimethoate
2009	Greece	Bemisia	tabaci	4A	Medium	High		greenhouse vegetables	AB, 11th Greek Entomology Congress	imidacloprid
	Greece	Bemisia	tabaci	9B	Medium	High		greenhouse vegetables	Slater	Pymetrozine
2009	Greece	Bemisia	tabaci	3A	Medium	High		greenhouse vegetables	AB, 11th Greek Entomology Congress	a-cypermethrin
2009	Greece	Bemisia	tabaci	1B	Low	Low		greenhouse vegetables	AB, 11th Greek Entomology Congress	pyrimiphos methyl
2009	Greece	Cydia	pomonella	1B	Medium	Low		Pome Fruit	AB, 11th Greek Entomology Congress	azinthos methyl & phosalone
2009	Greece	Cydia	pomonella	3A	Medium	Low		Pome Fruit	AB, 11th Greek Entomology Congress	deltamethrin & fluvalinate
2009	Greece	Cydia	pomonella	15	Medium	Medium		Pome Fruit	AB, 11th Greek Entomology Congress	diflubenzuron+
2009	Greece	Cydia	pomonella	18	Medium	Low		Pome Fruit	AB, 11th Greek Entomology Congress	tebufenozide
2009	Greece	Cydia	pomonella	4A	Medium	Low		Pome Fruit	AB, 11th Greek Entomology Congress	thiacloprid
2009	Greece	Cydia	pomonella	7B	Low	Low		Pome Fruit	AB, 11th Greek Entomology Congress	fenoxycarb
2009	Greece	Myzus	persicae	4A	Low	Low		Tobacco	AB, 11th Greek Entomology Congress	imidacloprid
2009	Greece	Myzus	persicae	3A	Medium	Low		tobacco-peach	AB, 11th Greek Entomology Congress	deltamethrin
2009	Holland/Belgium	Meligethes	aeneus	3A	High	Medium	90% Resistant in 2009	Oil Seed Rape	Slater	Pyrethroids
2009	Holland/Belgium	Tetranychus	urticae	21	High	Medium		Vegetables/Ornamentals	Nauen	METI acaricides
2009	Holland/Belgium	Tetranychus	urticae	6	Medium	Medium		Vegetables/Ornamentals	Nauen	Abamectin
2009	Holland/Belgium	Tetranychus	urticae	UN	Low	Low		Vegetables/Ornamentals	Nauen	Bifenazate
2009	Holland/Belgium	Tetranychus	urticae	20B	Medium	Medium		Vegetables/Ornamentals	Nauen	Acequinocyl
2009	Holland/Belgium	Tetranychus	urticae	10A	High	High		Vegetables/Ornamentals	Nauen	Hexythiazox
2009	Italy	Aphis	gossypii	1A	Medium	Medium		Potato	AB, GIRIF, Italy	Pirimicarb
2009	Italy	Bemisia	tabaci	3A	Medium	Medium		Vegetable-Ornamentals	AB, GIRIF, Italy	Deltamethrin
2009	Italy	Cydia	pomonella	1B	Medium	Low		Apple	AB, GIRIF, Italy	Azinphos-methyl, clonirifos+

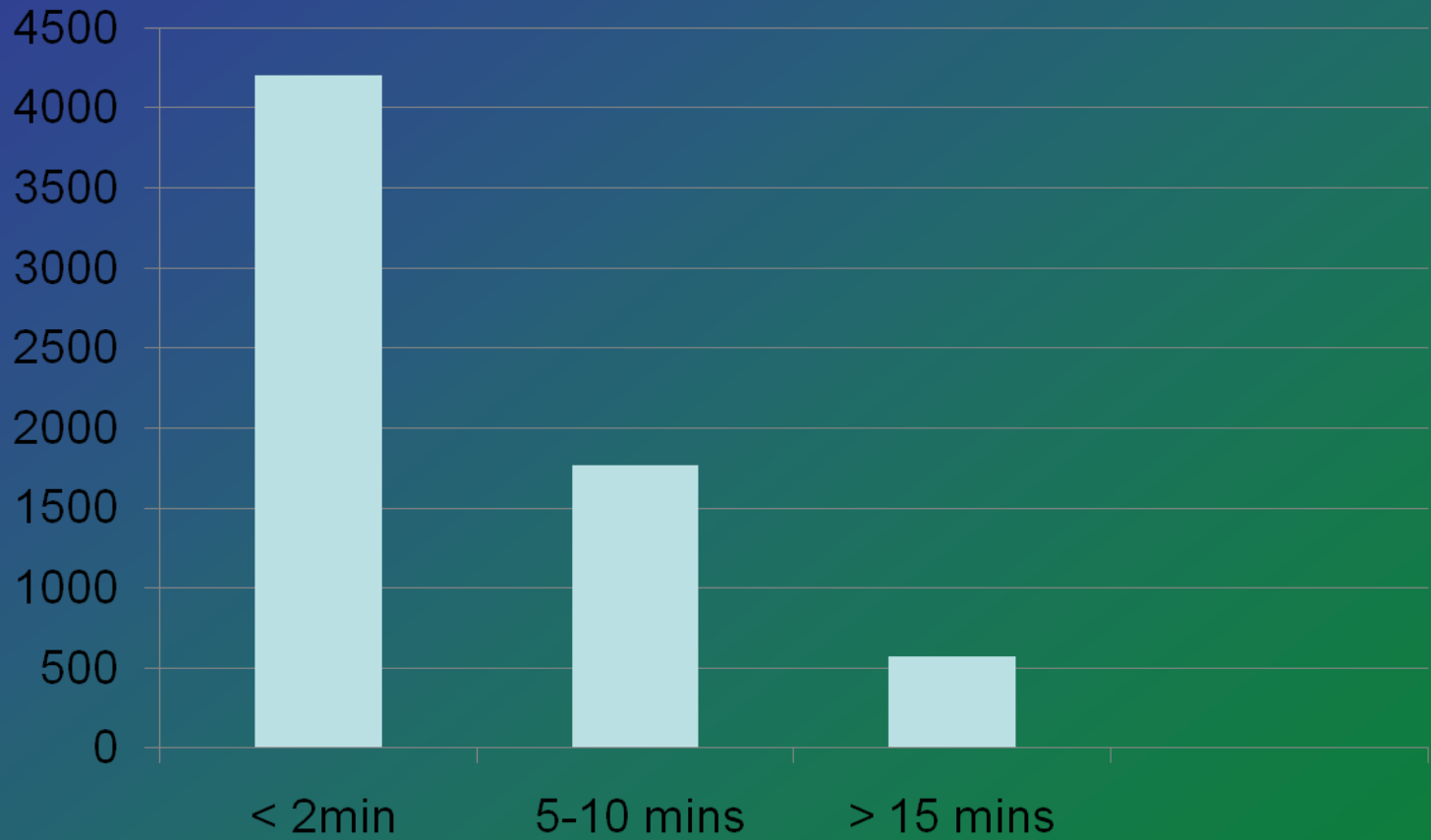

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Number of Record: 406

ID	Year	Country	State	Genus	Species	IRAC #	Status	Impact	Comments	Crop
I0401	2007	Germany		Aphis	frangulae	3	Medium	Medium		Potato
I0199	2007	USA		aphis	gossypii	1B	High	Low	Widespread, still effective for one spray per year	cotton
I0200	2007	USA		aphis	gossypii	3	High	Medium	Widespread, still effective for one spray per year	cotton
I0201	2007	USA		aphis	gossypii	4A	Low	Medium		Veg/melon
I0302	2007	Germany		aphis	gossypii	1A	Medium	Medium		Potato
I0327	2007	Italy		aphis	gossypii	1A	Medium	Medium		Potato
I0338	2007	Portugal		aphis	gossypii	3	Medium	Low		Vegetables
I0396	2007	Spain		aphis	gossypii	1A	High	Medium		Orange
I0403	2007	Spain		Aphis	spriaecola	1A	High	Medium		Orange
I0312	2007	Greece		bactrocera	oleae	1B	Low	Low		Olive
I0202	2007	USA		bemisia	tabaci	1B	High	Medium		

March 2010 to 2011 Visits to the IRAC section of the APRD

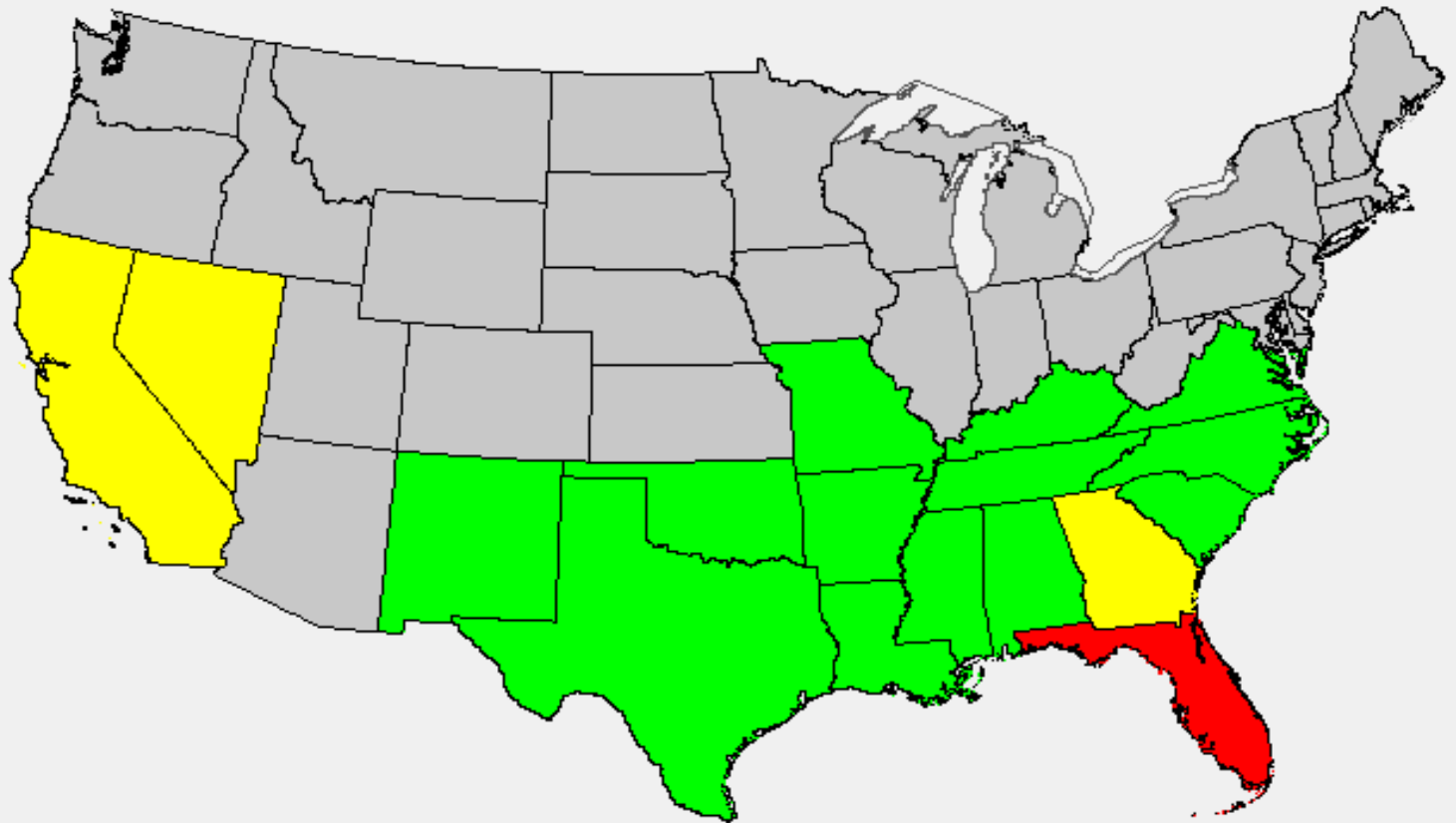


Impact Analysis of IRAC Cases (US Mainland)

The Impact Score (IS) is calculated as the impact value times the number of cases.
The impact values are: 1 -- Low, 2 -- Medium, 3 -- High, 4 -- Severe.

Impact Score

- 0
- 1-8
- 9-10
- 11 +



Resistance of Heliiothis Virescens to IRAC MOA#1B (US Mainland)

Impact

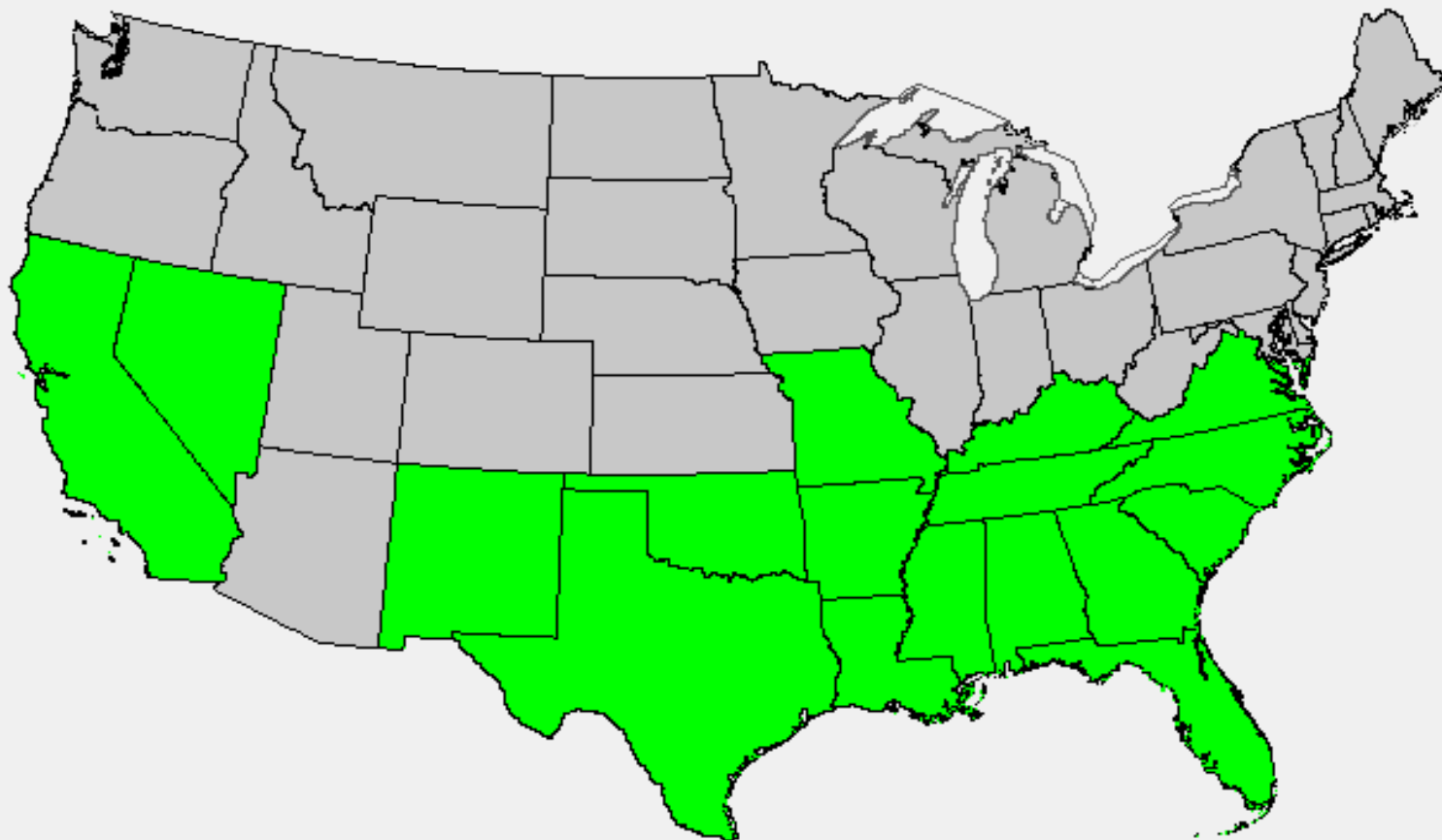
Unknown/None

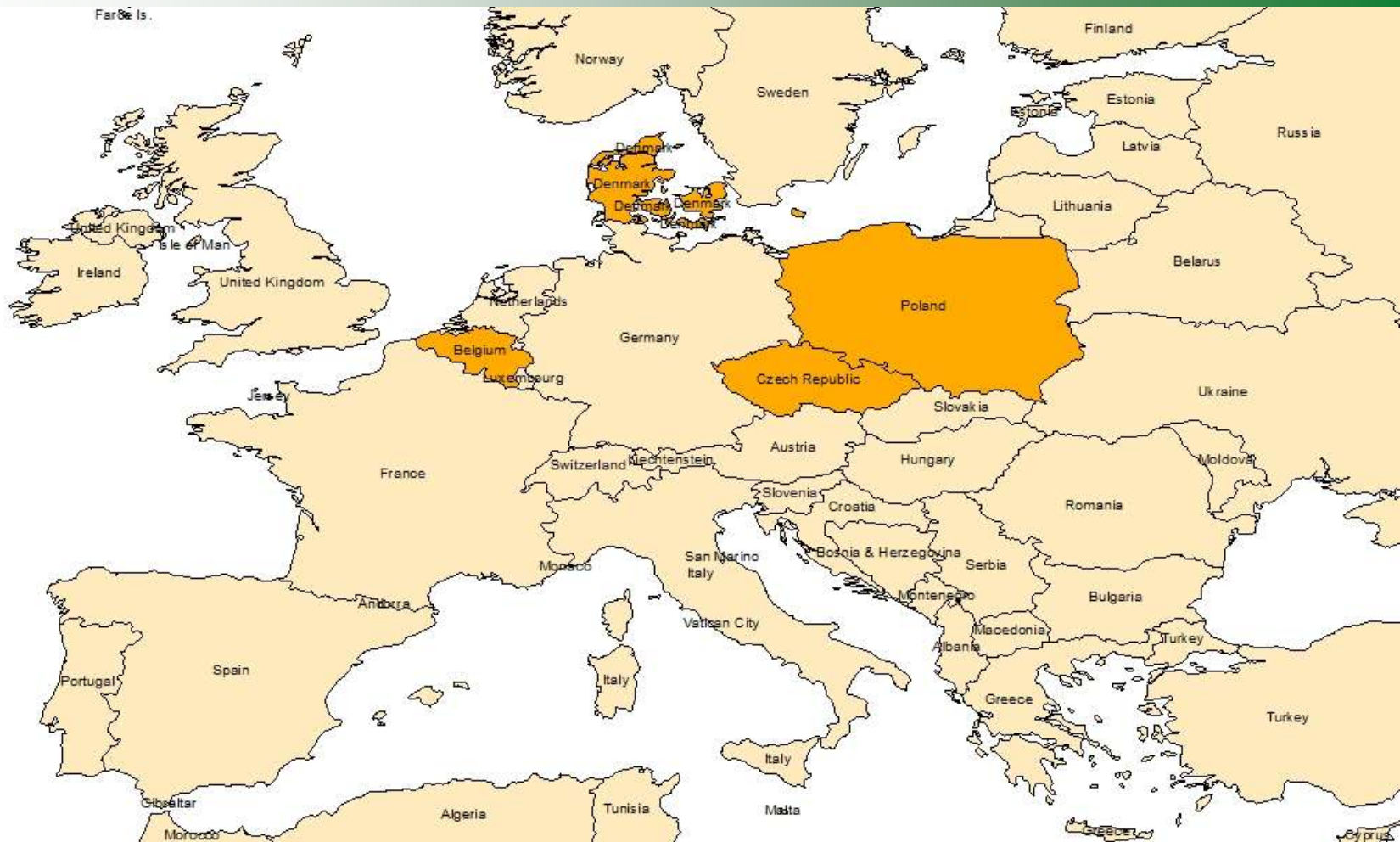
Low

Medium

High

Severe





Impact of the resistance of the pollen beetle (High) 2009



Insecticide Resistance Action Committee

Goals & SMART Objectives

(

Goals	Objectives	Timeline
Identify and track the scope and nature of insect resistance issues.	<ul style="list-style-type: none"> International industry expert survey with data on the occurrence and impact of insect resistance. 	On going
Inclusion of the IRAC expert survey into the on-line MSU database	<ul style="list-style-type: none"> To provide the public with perspective on the scope and impact of insect resistance as opposed to just the historical occurrence as now available. To get validation and additional input from comments from the global audience that will lead to strengthening and greater recognition of IRAC as the experts. 	Completing 4 th year
Improve utility of survey	<ul style="list-style-type: none"> Development of web searchable information, geography maps and statistical analysis 	Make a decision in 2011
Expand geographical coverage of survey	<ul style="list-style-type: none"> To engage additional country groups in the survey and expand geographical coverage 	Explore at Spring Meeting
Develop Succession Plan for post GT	<ul style="list-style-type: none"> To ensure continuity need to establish focal points in 2011 	March 2011