

Current knowledge regarding the Q biotype in the US --distribution and resistance status

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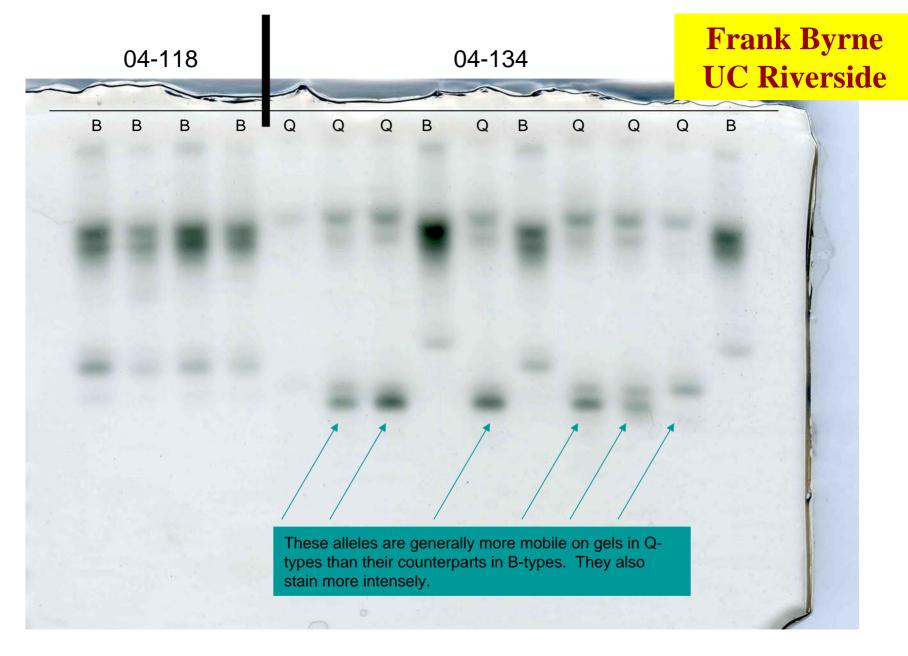


Outline

- 1. Background and evidence of first detection of Q biotype: Three labs, two methods
- 2. Evidence that we caught the problem relatively early: Arizona Whitefly Biotypes: 2001, 2003, 2004.
- 3. Evidence that the Q biotype poses a severe threat to whitefly IPM:

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- 5. Evidence of fitness costs of Q biotype.





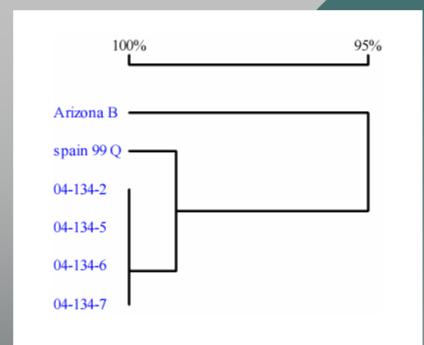
Testing of Poinsettia'04 strain by Frank Byrne, UC Riverside, using gell electrophoresis of esterases. The sample we sent Frank contained a mixture of Q and B biotypes.

O biotype Morocco 3 Spain Q1 Spain Q2 SP92 tomato-Spain Mt COI tree SP95 tomato-Spain Spain Almeria GH Q PO-4coi-1.seq PS-5coi-1.seq PS-1coi-1.seq poinsettia-04 O-like Morroco 1 PS-2coi-1.seq PS-3coi-1.seq SG Sudan samples. clade + SC Sudan SUDANSC PO-1coi-1.seq PO-5coi-1.seq SP99 cuke Spain1 SP99 cuke Spain2 Tucson Dec relatives 04 Unpublished PO-2coi-1.seq data Brown TC Turkey SUD3.1 SUD3.2 /Dennhey NIG cowpea 1 NIG cowpea2 SUDB2.2 SUDB2.3 SUDB1.3 labs LosMochis04.2B SA99.18 (B) South Africa LosMochis04.1B AZ (B) 2000 SA99.19 (B) South Africa ARG5 (B) Chaco Argentina - Taiwan B FC (B) Florida GC (B) Guatemala CC (B) California B-like clade + IS (B) Israel ARG4Buenos AiresB close relatives JW (B) Japan AZ(B) 88 Arizona - MALAYSIASonchus Turkey(B)01 UAE6.1 India B SKorea (B) ISRAEL 5 Euphorbia M94125 GuatWF2 (B) 01 Puerto Rico (B) 1997 MEX11Sid Tepic MX Sida spp.1 WFMX 9 Srostratum Nayarit MEXISola MX 1 Srostratum Tepi Honduras 3 MEX7Tob WFMX 7 tobacco Nayani MXWF1 (non B) 01 MXWF2 (non B) 01 Honduras 2 CAL (A) Salinas Riverside A 00 AZ-A like + - Pan7iEhetero Caribbean + So MEX13Squ MX 13 Tuxtla Cmaxima American clades - MEX8Ama Honduras 1 Honduras 1 Honduras 4 MEX5Sida AZ(A) 88 Arizona CUL Mexico SIDA-PR 99 Jat PR 00 Jat PR 00 Jat PR04 JAT Puerto Rico ARG1BeanSalta ARG3 IpomoeaTucaman Bolivia 99 HC China MALAYSIAMalvaM94047 THPoin PC91-Pakistan PC95-Pakistan PC95-Pakistan INDIA 34 NEW-Nepal PC92-Pakistan Asian/Australian clades IW India - CameroonP 8B CamPendaBokoW16 — CamBambulW15 Spain S new African TAN2Cab TAN3Cas ABABenin clades TaiwanBtab1 - UGNAMSwP B herbericola CA T abutalonea 1.2 Outgroups 15 10 20

Judy Brown's Lab

Comparative sequence analysis with reference sequences indicated that Poinsettia'04 whiteflies were most closely related to haplotypes from southern Spain greenhouses, sharing 98.0-99.7% nucleotide identity.





EARML Analyses

The Poinsettia'04 strain had greater than 99% mCO1 sequence homology with the Spain Q haplotype and less than 95% homology with the Arizona B haplotype

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Homology matrix of 6 sequences
Arizona B 100%

spain 99 Q 94.2% 100%

04-134-2 94.9% 99.3% 100%

04-134-5 94.9% 99.1% 100.0% 100%

04-134-6 94.9% 99.1% 100.0% 100.0% 100%

04-134-7 94.8% 99.1% 100.0% 100.0% 100.0% 100%
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Tracking Q in 2005 ADA and CDFA



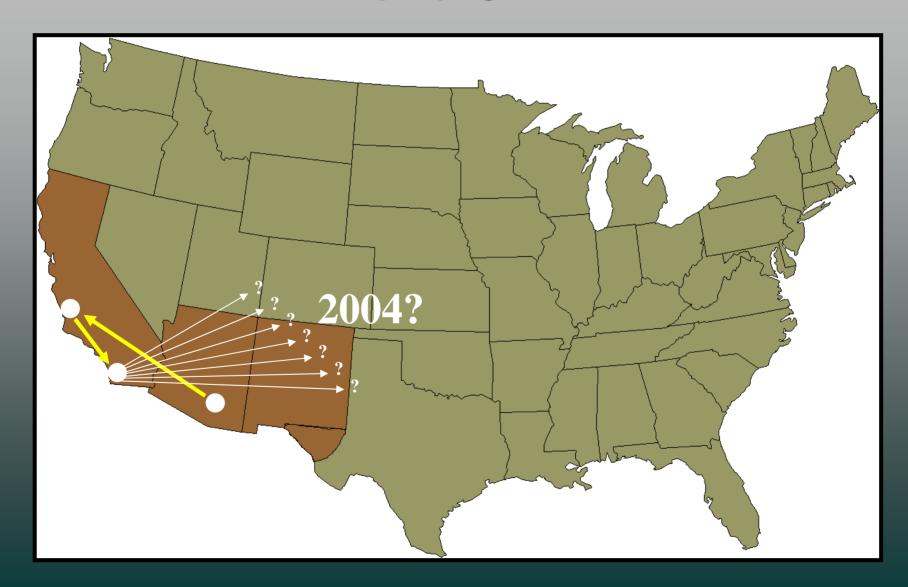
1.5 Million Square Feet of Greenhouse

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Begonia												
<u>Begonia</u>												
Calendiva						1						
Calla Lily										,		
Calla Lily												
Mini Carnation												
Chenille						1000			1			
Cineraria												
Cyclamen						J.						
Daffodil												
Exacum												
Gerbera												
Hibiscus												
Hyacinth												
Hydrangea								į,				
lvy												
Kalanchoe												
Easter Lily												
Oriental Lily												
Lisianthus												
Mum									100			
Poinsettia												
Pothos										1		
Tulip									_	5/		

Resistant Whiteflies Shipped to Tucson on Holiday Poinsettias



Tracking Q in 2005 ADA and CDFA

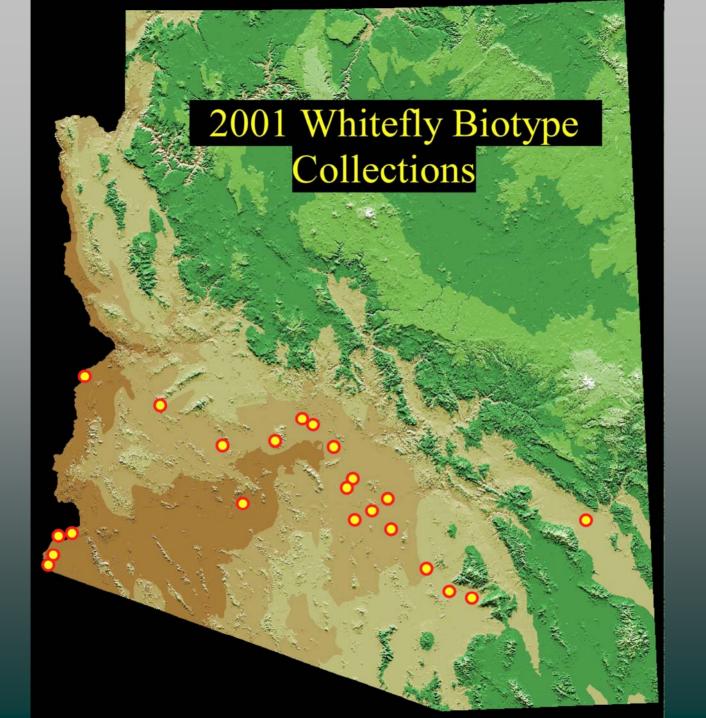


Outline

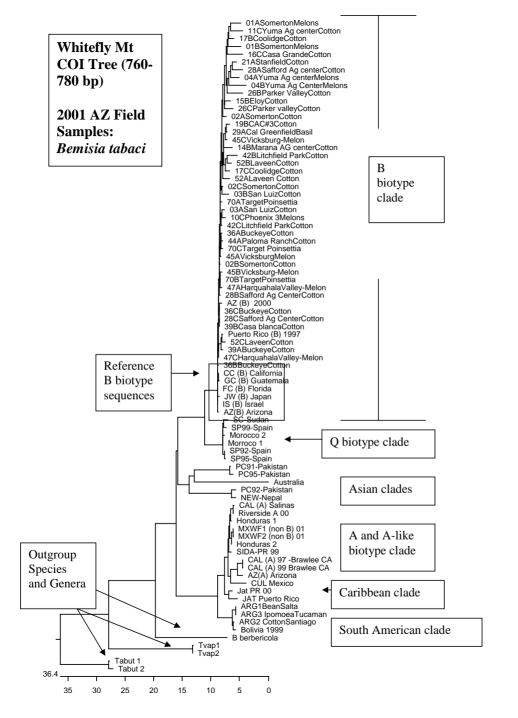
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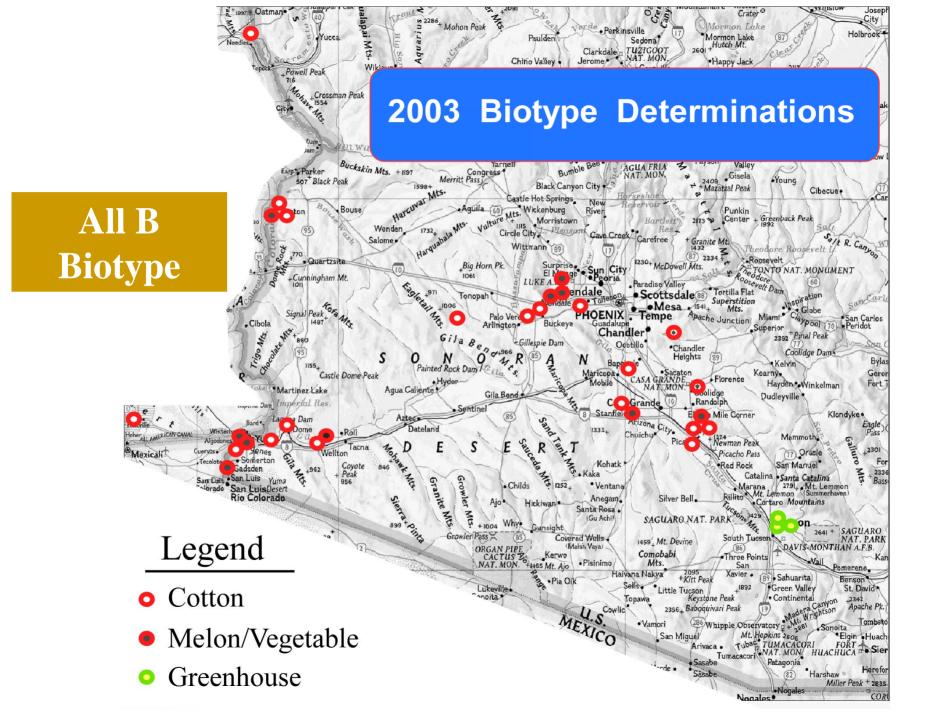


43 different Arizona whiteflies collected in 2001 from 22 different locations (highlighted).

Cultures were reared by EARML and tested jointly by personnel from EARML and Judy Brown's laboratory.

All were the B biotype.





1097 Oatman · Perkinsville Holbrook Mormon Lake **2004 Biotype Determinations** One Q on Rim Show Gisela collection 507 Black Peak Mazatzal Peak Black Canyon City Cibecue . Wickenburg Center + Greenback Peak from Bartlett Wittmann 189 · Quartzsite ooinsettia Big Horn Pk. Cunningham Mt. • Scottsdale 88 Signal Peak PHOLINIX . Tempe Apache Junction 2392 Pinal Peak Painted Rock Dam 1 Castle Dome Peak Hayden Winkelman Eleven Mile Corner Klondyke • Dateland Mexicali Catalina Santa Catalina San LuisDesert Río Colorado Anegam. Santa Rosa . SAGUARO NAT. PARK Covered Wells 1459 Mt. Devine Legend Comobabi NAT. MON. 41465 Mt. Ajo laivana Nakya Xavier . St. David Cotton Melon/Vegetable Greenhouse/Urban

2005 Biotype Determinations (in progress)

Field samples

05-19	South Gila valley	cotton	5	В
05-106	Paloma	cotton	10	В
05-09	Cotton Center	cotton	7	В
05-10	Stanfield	cotton	8	В
05-103	Goodyear	cotton	9	В
05-06	Somerton	cotton	3	В
05-08	Queen Creek	cotton	6	В
05-17	Holtville	cotton	6	В
05-03	Maricopa Ag. Center	cotton	4	В



2005 Biotype Determinations

Retain Nursery Samples

GPS ID	Location	<u>Host</u>	N	Biotype
05-111	Wild Oats-Tucson	poinsettia	7	Q
05-115	Trader Joes-Tucson	poinsettia	7	Q
05-114	Fry's-Tucson	poinsettia	6	Q
05-38	Fry's-Phoenix	poinsettia	9	Q
05-112	Home Depot 2-Tucson	poinsettia	10	Q
05-116	Lowes-Tucson	poinsettia	8	Q
05-109	Green Things A	poinsettia	8	В
05-110	Green Things B	poinsettia	10	В
05-29	Home Depot 1-Tucson	poinsettia	6	В
05-113	Target 2- Tucson	poinsettia	7	В
05-39	Walgreens-Phoenix	poinsettia	11	В
05-40	Home Depot 3-Phoenix	poinsettia	7	В
05-28	Target 1-Tucson	poinsettia	9	В



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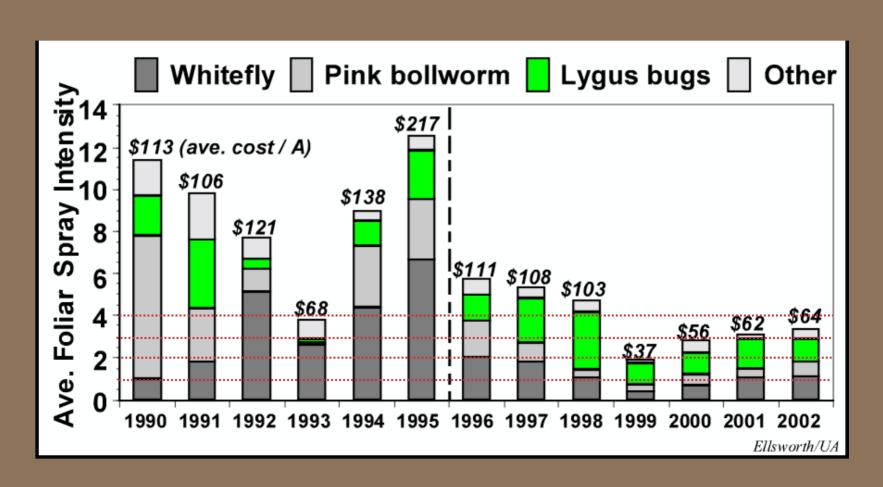
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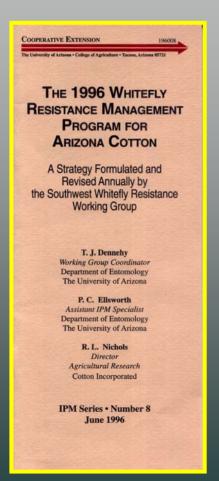
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Insecticide Use in Arizona Cotton—Data Based on Polling



Arizona's IGR-based resistance management strategy



Stage I: Insect Growth Regulators

Threshold: 0.5-1 large nymph per leaf disk <u>AND</u> 3-5 adults per leaf

Use IGR of choice when whitefly counts exceed threshold

IGR	Use Rate	Restrictions	Mode of Action
Applaud (70WP)	8 oz./A	Use only once per season. Apply no sooner than 21 days after Knack	Chitin synthesis inhibitor; effective against nymphs.
Knack (0.86EC)	8 fl. oz./A	Use only once per season. Apply no sooner than 14 days after Applaud	Juvenoid; sterilizes adults and eggs; prevents adult emergence.

Stage II: Non-Pyrethroids

Threshold: 5 adults per leaf

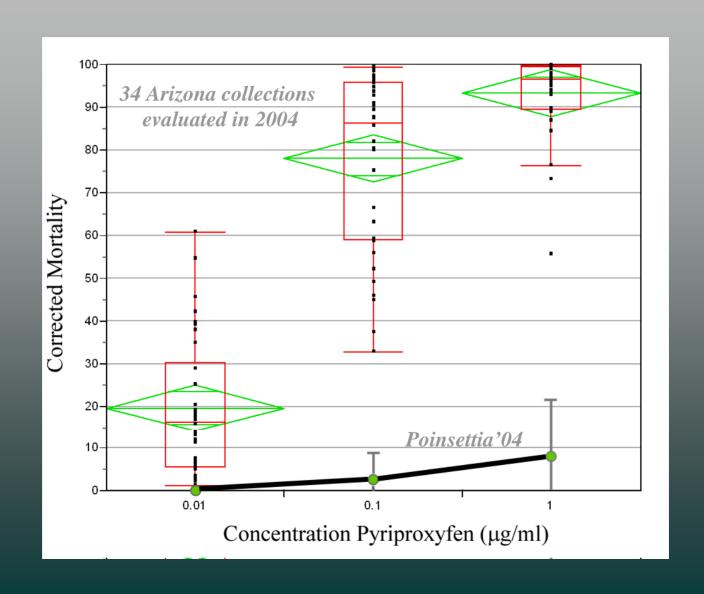
- When populations average more than five adults per leaf, use Stage II materials at least once before using Stage III materials, in order to delay the need for pyrethroids.
- Rotate among classes of insecticides and among different insecticides within classes.
- 3. Do not use mixtures of more than two compounds.
- Use no active ingredient more than twice per season.

Stage III: Pyrethroid Mixtures

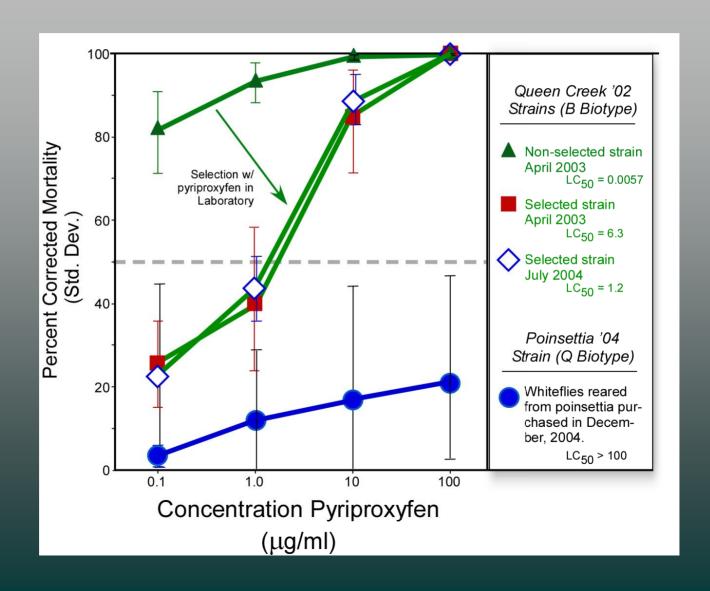
Threshold: 5 adults per leaf

- Delay pyrethroid use until the end of the control season approaches (for example, September – October).
- Plan to use the pyrethroid class no more than twice per season.
- Rotate the classes of the compounds tank-mixed with the pyrethroid and rotate among pyrethroids.

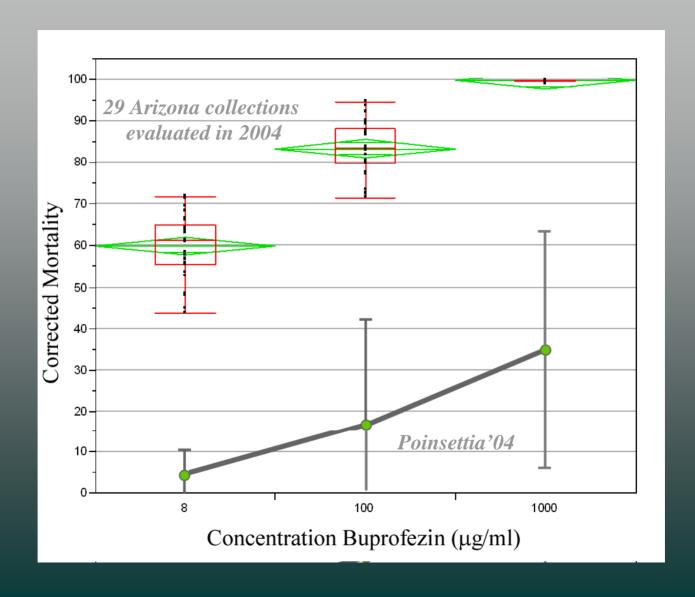
Pyriproxyfen (Knack®)



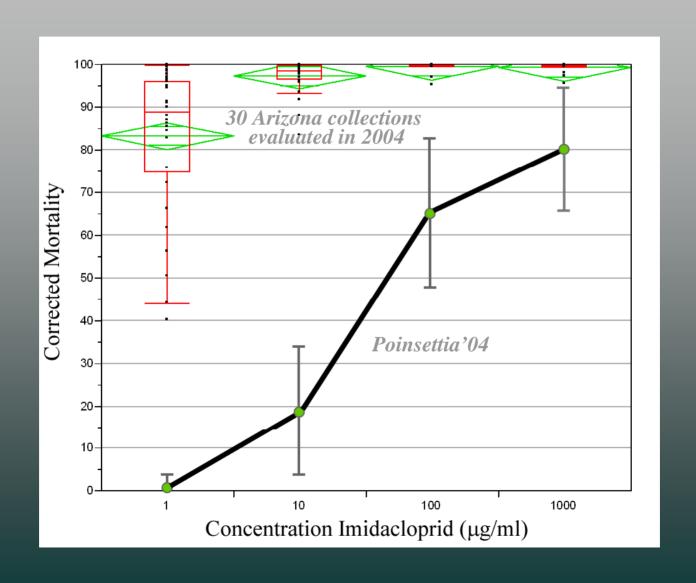
Bvs. Q Biotype Resistance



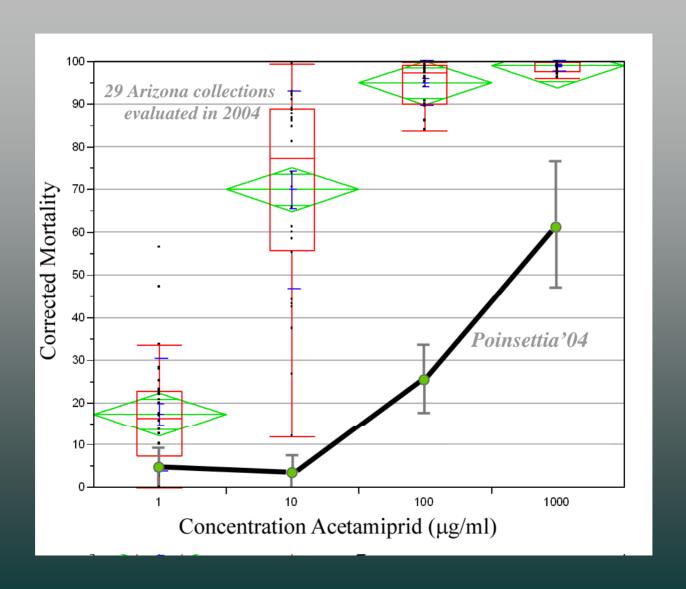
Buprofezin (Courier®)



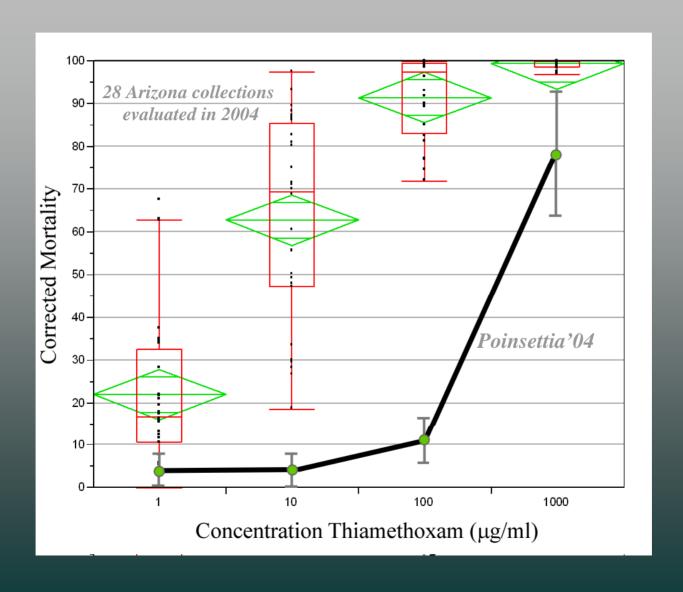
Imidacloprid (Admire® etc.)



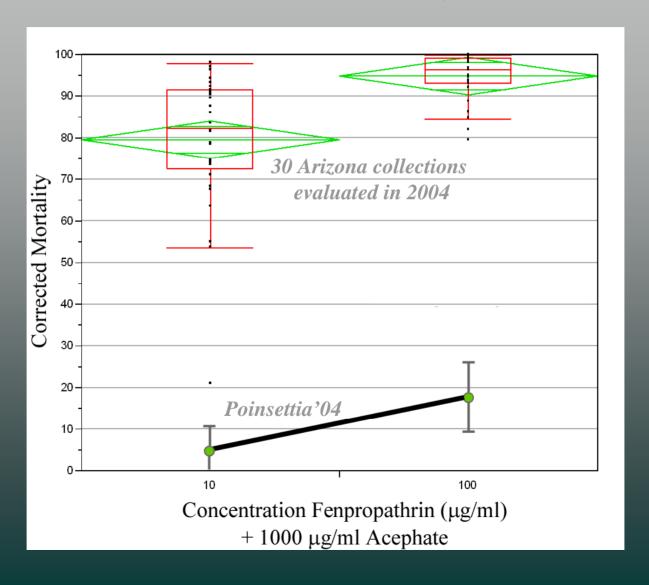
Acetamiprid (Intruder® etc.)



Thiamethoxam (Centric® etc.)



Fenpropathrin + Acephate (Danitol + Orthene® etc.)



Dinotefuran (Safari®)

	Yuma '04	Poinsettia '04	RR
LC_{10}	2.40	3.46	1.4
LC_{50}	21.4	87.9	4.1
LC_{90}	191	2,230	12



Spiromesifen (Oberon®)

	<u>'04</u>	Poinsettia '04	RR
LC_{10}			
LC_{50}			-
LC_{90}			

Data being summarized. Conclusion = Oberon was highly toxic to both Yuma '04 and Poinsettia'04. Mortality of Poinsettia'04 was slightly less at the concentrations tested.

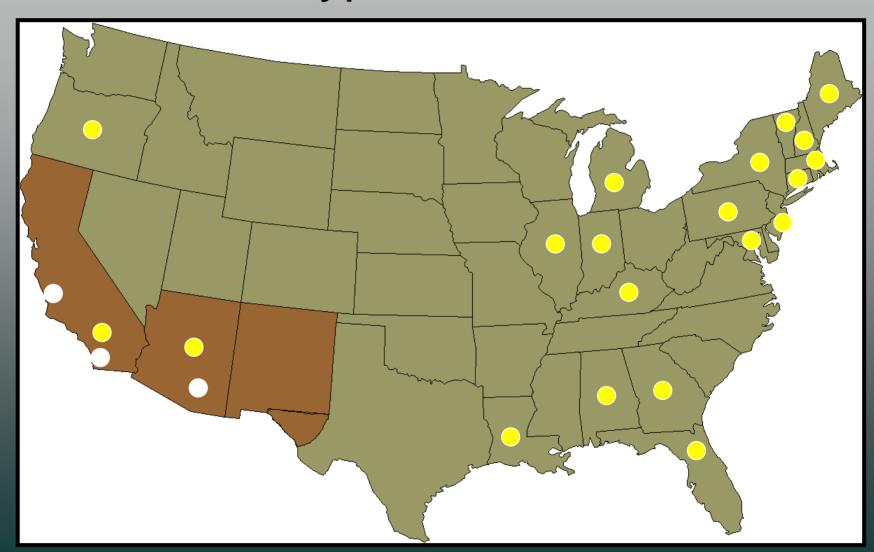


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2005 Surveys Q Biotype Task Force



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All 8 Isolated Cages of Poinsettia'04 shifted to the B biotype

- Individual cages selected with high concentrations of buprofezin, pyriproxyfen, or imidacloprid.
- Maintained in cages, within isolated room within another basement room. No windows. No other cultures.
- Large reduction in resistance within 6 months.



Evidence of fitness costs

- Insert schematic demonstrating culturing of Poinsettia'04
- Data showing change in susceptibility to pyriproxyfen over time
- Data showing loss of Q biotype over time

