Managing the US invasion of Cryptic Whitefly Species: Q vs. B whiteflies.

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Bemisia

Geographical Range

- Globally Distributed
- All Continents except Antarctica
- Probably moved on Ornamental plants

Bemisia tabaci

- **1889** Tobacco in Greece
- **1897** Sweetpotato in U.S. Florida-Type Specimen
- **1928** *Euphorbia hirtella* in Brazil
- **1950s** Cotton in Sudan & Iran
- **1961** El Salvador
- **1962** Mexico
- **1968** Brazil
- **1974** Turkey
- **1976** Israel
- **1978** Thailand
- **1981** Arizona & California
- **1984** Ethiopia
- **1985** Hibiscus in Apopka, Florida **B-biotype**

Whitefly History

- Whiteflies from the genus *Bemisia:*
  - have caused problems since at least 1929
  - form a complex of species and/or biotypes

Biotype A

Biotype B

Biotype Q

Whitefly History

- **Biotype A** (present in US before invasion by other biotypes) least common whitefly biotype.
- **Biotype B** or MEAM1 = (*Bemisia argentifolii* = *Bemisia tabaci*) most common whitefly
- **Biotype Q** or MED

Biotype A
Displaced

Biotypes

B & Q

IPM 1985

Whitefly History

- Prior to the 1986 the most common whitefly was Greenhouse whitefly.
- The reason B-biotype became established was a combination of its natural reproductive ability and its ability to develop resistance to insecticides.
- The implementation of IPM systems that combined new more targeted chemistries allowed for the successful control of B- biotype (i.e. Marathon and Distance).

Damage

Honey Dew

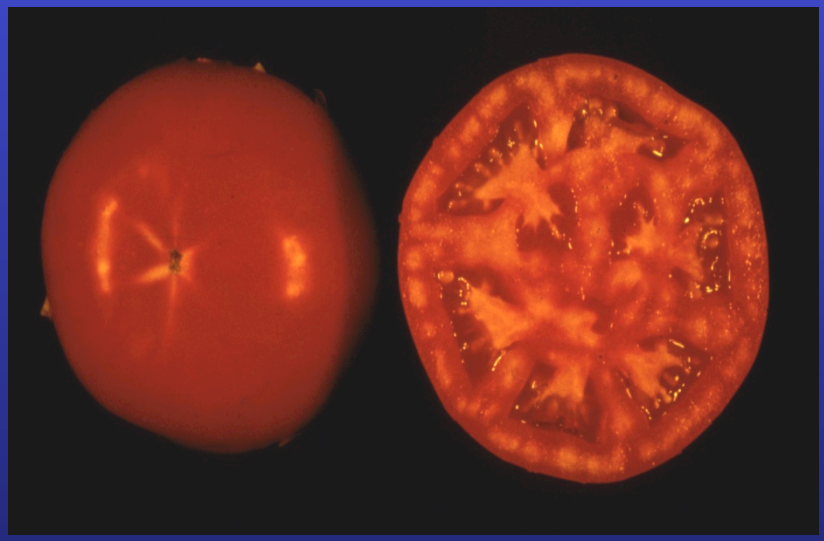
Sooty Mold

Sooty Mold

IRREGULAR RIPENING

External symptoms

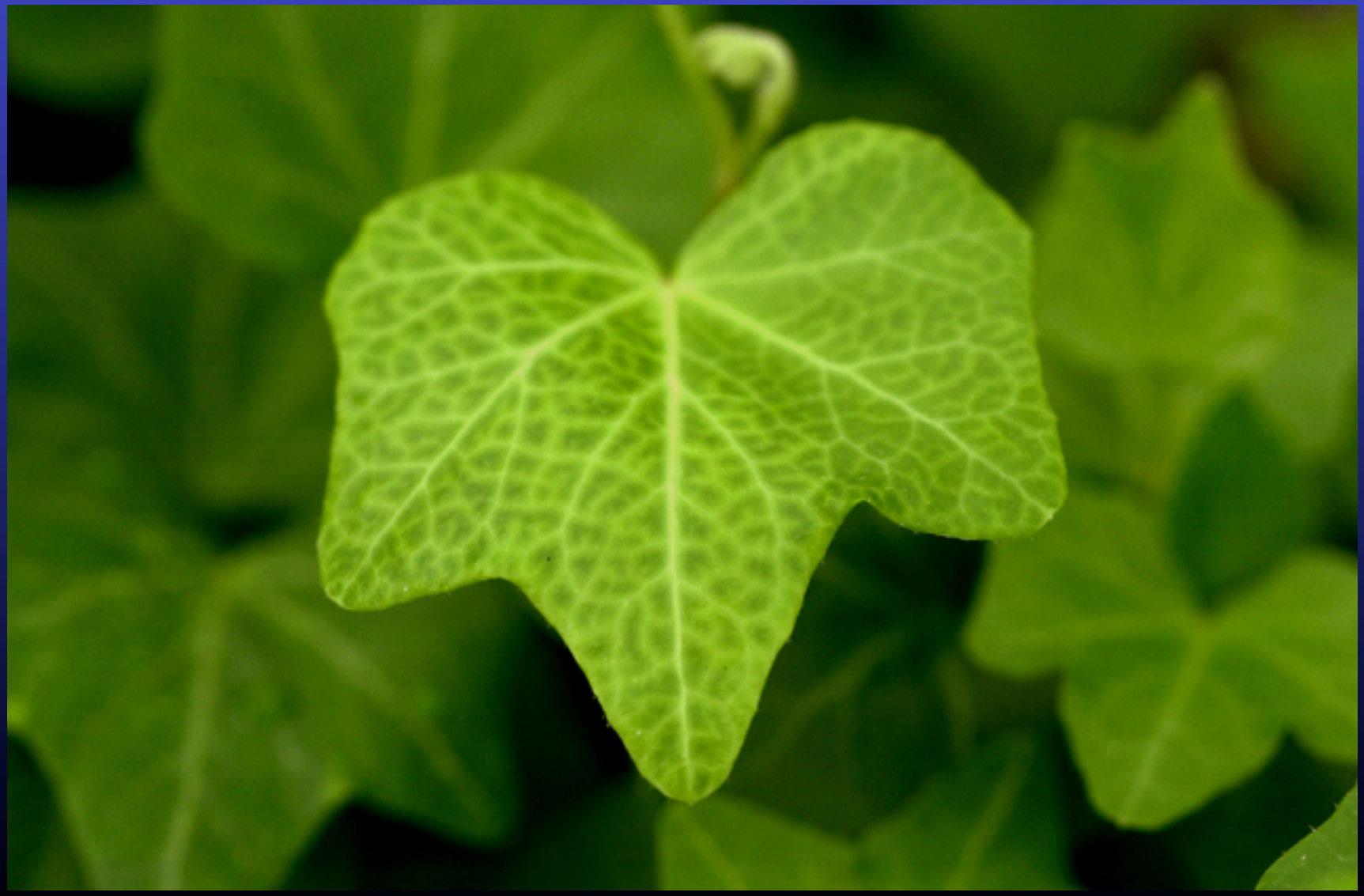
Internal symptoms



Photos: Dr. David J. Schuster

Physiological Disorders

Physiological Disorders



Virus Transmission

Impact

SINCE THE 1980s:

***B. tabaci* population outbreaks and *B. tabaci*-transmitted viruses have become a limiting factor in the production of food and fiber crops in many parts of the world (Brown, 1994)**

“Whiteflies and the viruses they carry comprise two of the worst crop pests of all times. Devastating in their effects, particularly for resource-poor farmers, these pests are found throughout the tropics and subtropics…..”

Building a Knowledge Base for Global Action (August 2005). Edited by: Pamela K. Anderson and Francisco J. Morales.

“Their control presents such major challenges that many nations, which otherwise do not regulate agriculture, have instigated legal measures.”

Building a Knowledge Base for Global Action (August 2005). Edited by: Pamela K. Anderson and Francisco J. Morales.

African cassava mosaic virus

FAO Photo

Tomato yellow leaf curl virus (TYLCV)

United States

- 1991-92 $200-500 million (multiple commodities)
- Imperial Valley, CA 1991-95 $100 million annually
- Arizona, California & Texas 1994-98 $153.9 million spent to prevent sticky cotton
- Gonzalez (1992) for every $1 million dollars of primary-induced crop loss $1.2 million in lost personal income as well as the elimination of jobs

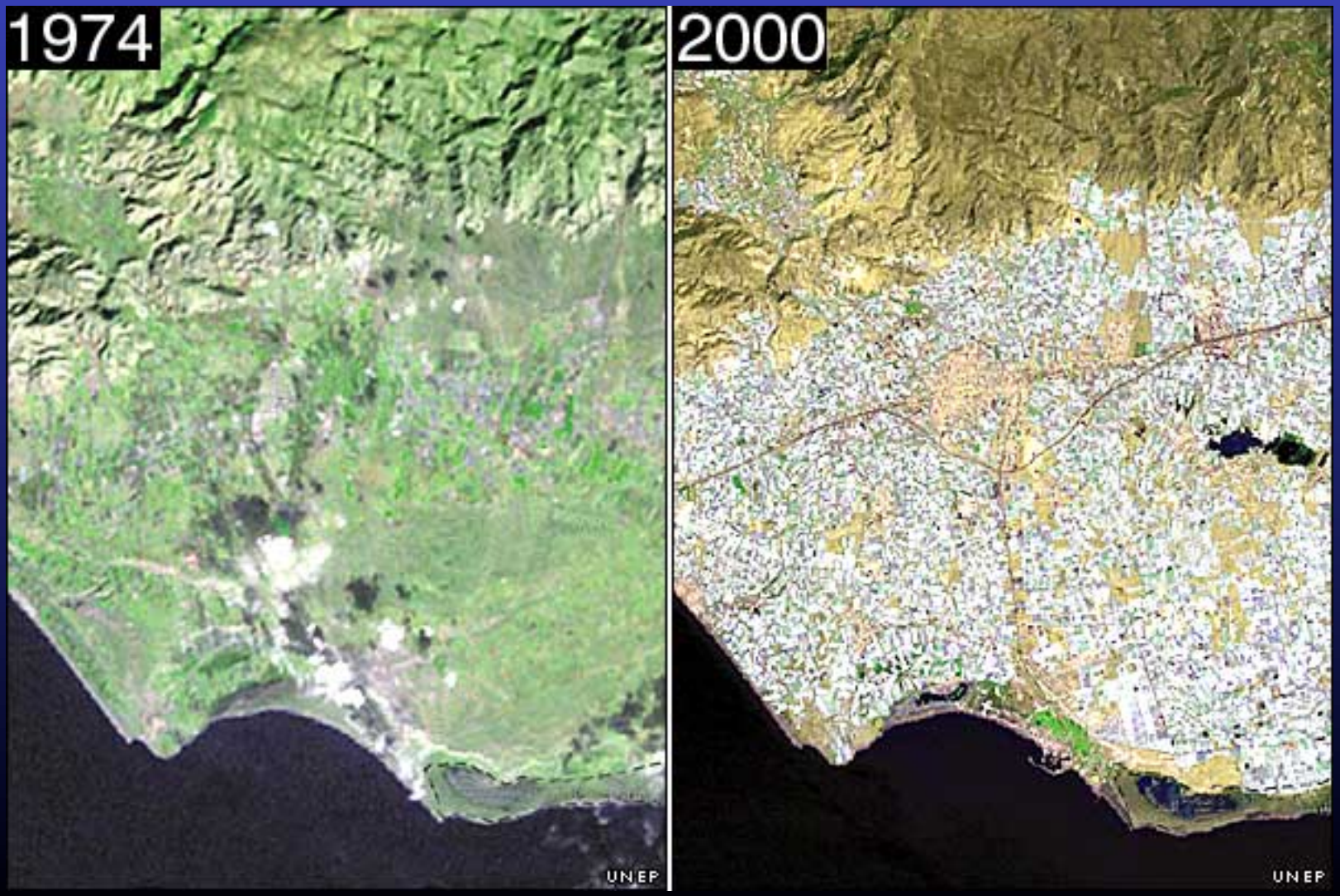
Q-biotype


Bayer
VANCED
GARDEN
Rose & Flower
Insect Killer
READY-TO-USE
Kills on contact
protection
NET CONTENTS 24 FL OZ (709mL)

Biotype Q

- The Q-biotype was originally found in the Iberian peninsula (Spain & Mediterranean), but has since spread.
- Potential US impact on:
  - Cotton – sticky fiber and virus
  - Specialty Food Crops - virus
  - Ornamentals – aesthetic damage and trade.

Agricultural Expansion in Almeria
Q-Biotype



United States Detection

- Collected from poinsettia in a retail organic produce market in Arizona (Dec. 2004)
- Identified months later as bioassays were conducted and samples processed.

United States Detection

- Part of the Arizona Resistance Monitoring Program for Cotton and Vegetable Industries.
- The poinsettia-04 strain showed significant resistance to 2 major classes of pesticides used in cotton and so it stood out from ALL other whitefly samples.

Response

- Initial response by regulators was to quarantine nurseries in California after Trace Backs from the find in Arizona
- Industries at odds about what the appropriate response should be.
  - Some commodity groups wanted much stricter regulations placed on the movement of ornamental plants.

ZERO TOLERANCE

Growers can't tell the difference between Q-biotype and B-biotype or between European and non-European populations…

KILL THEM ALL

What are the real Q issues?

- Resistance development (all biotypes)
- Regulation of pests already widely distributed – at the subspecies level (biotypes or strains).
- Movement of pests on plant material and the REACTION by other commodities-initial response was to stop all shipment of poinsettia.

Response

- 3-Pronged Task Force
  - Industry
  - Regulators
  - Technical Advisory Committee

Whitefly Taskforce

INITIALLY - To facilitate the national discussion of the Q-Biotype of the whitefly, *Bemisia tabaci,* in order to prevent or minimize the pest's potential effects on various industries within American agriculture"

Whitefly Taskforce

- Industry Leadership
- Technical Committee
- Interagency Working Group

Dr. Osama El-Lissy, Deputy Administrator, APHIS-PPQ

Lin Schmale, Senior Director of government Relations, Society of American Florists (SAF)

Whitefly Taskforce

Industry Leadership

Technical Committee

Interagency Working Group

- Cotton
- Floriculture
- Nursery
- Vegetables

Whitefly Taskforce

Industry Leadership

Technical Committee

Interagency Working Group

Major Roles

Identifying the overall goals and objectives;
short and long-term practical solutions that help affected industries, as a whole, in combating the pest in the most effective and efficient manner

Whitefly Taskforce

Industry Leadership

Technical Committee

Interagency Working Group

Twenty technical experts work together to provide the technical information necessary to meet the goals and objectives of the taskforce

Whitefly Taskforce

Industry Leadership

Technical Committee

Interagency Working Group

Tim Dennehy, University of Arizona
Lance Osborne, University of Florida
Christi Palmer, IR4
Cindy McKenzie, ARS, FL
Dave Schuster, University of Florida
David Byrne, University of Arzona
Frank Byrne, University of California
Jim Bethke, University of California
Judy Brown , University of Arizona
Matthew Ciomperlik, APHIS-CPHST
Peter Ellsworth, University of Arizona
Phil Berger, APHIS-CPHST
Phil Stansly, University of Florida
Robert Nichols, Cotton Incorporated
Robert Staten, APHIS-CPHST
Ronald Oetting, University of Georgia
Scott Ludwig, Texas A&M
Steve Naranjo, ARS, AZ
TX Liu, Texas A&M

Whitefly Taskforce

Industry Leadership

Technical Committee

Interagency Working Group

Major Tasks

- Detection and Survey
- Diagnostics
- Pest Management Plans
- Outreach
- Practical Biology & Ecology

Whitefly Taskforce

Industry Leadership

Technical Committee

Interagency Working Group

Federal and State regulatory officials from potentially impacted states work together in designing and implementing operational plans to prevent or minimize the pest's impact on the various industries.

Q-Biotype Whitefly Taskforce

2005-2006

- Detection and Survey
- Diagnostics
- Pest Management Programs
- Offshore Activities
- Outreach

SURVEY

Bemisia tabaci Q-biotype Survey Ground Rules

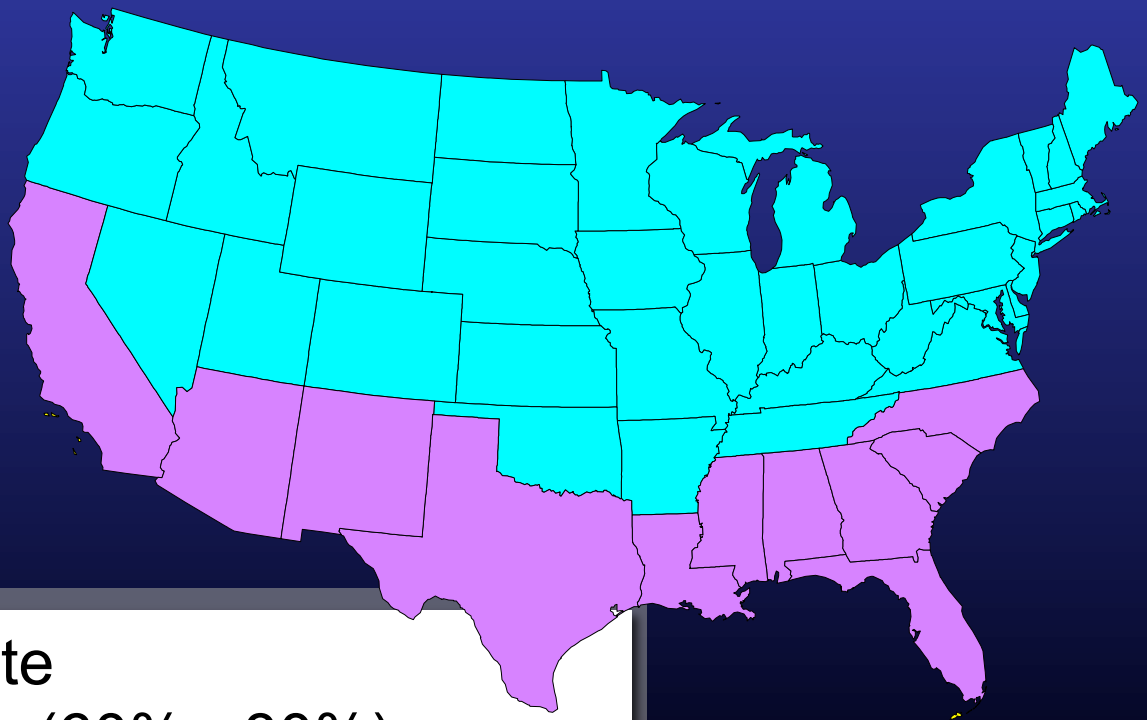
- APHIS will not regulate.
- States agreed to allow growers to submit samples anonymously and to not impose a quarantine if Q was found.
- Only required to report the State and the Crop

Q-Biotype Whitefly Survey 2005

Sample Processing

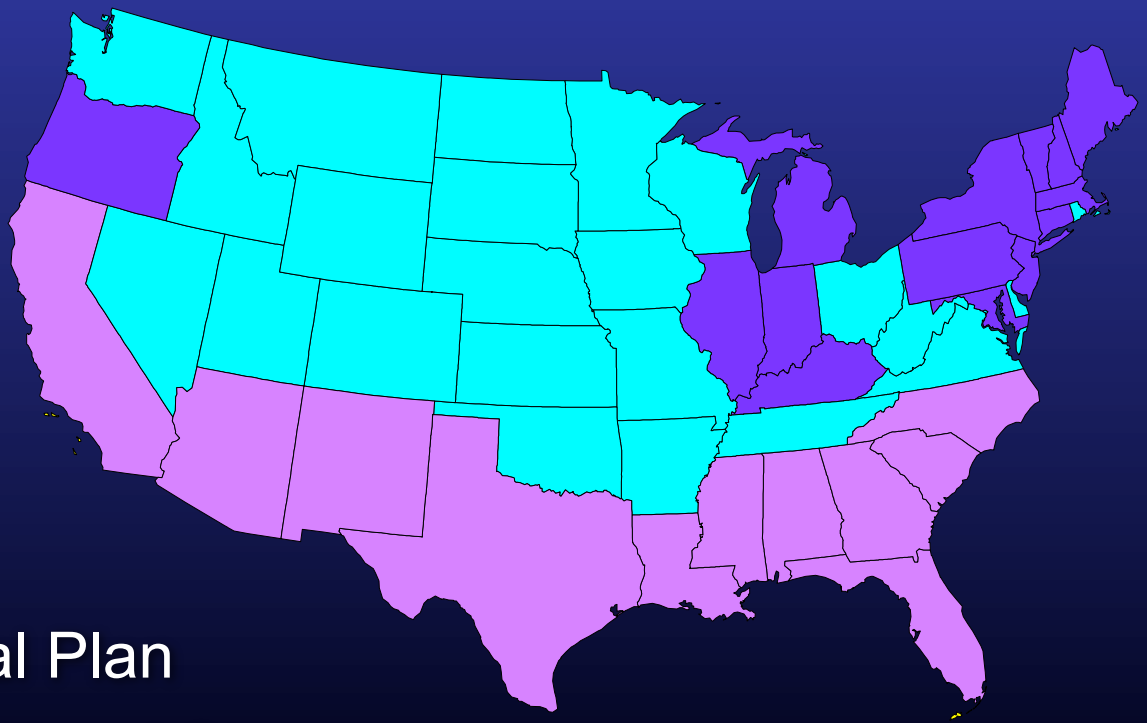
- California, CDFA
- Frank Byrne, University of California
- Cindy McKenzie, ARS, FL
- Judy Brown , University of Arizona

Q-Biotype Whitefly Survey 2005



- 30 sites/State
- Greenhouse (60% - 80%)
- Open Environment (20% - 40%)

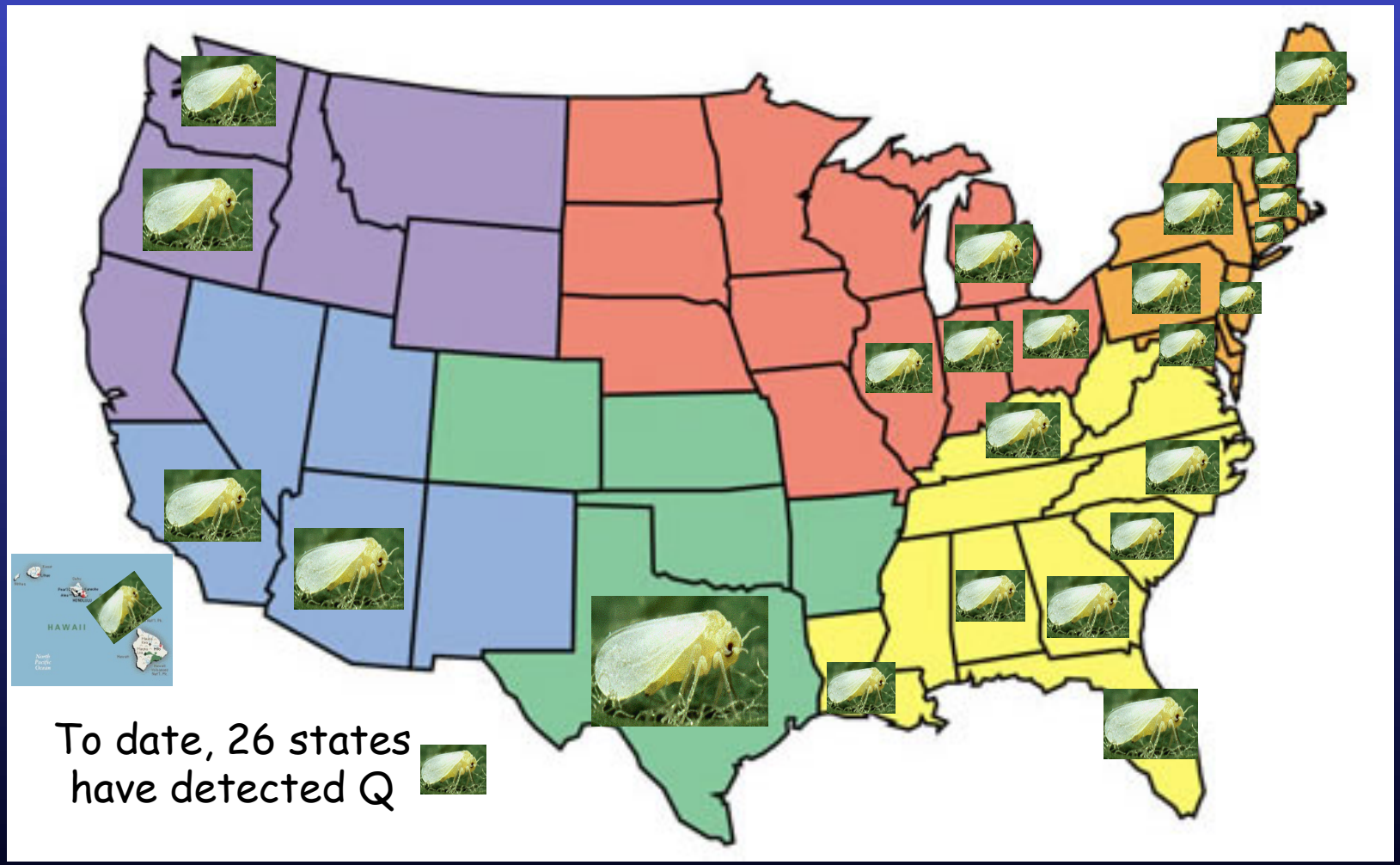
Q-Biotype Whitefly Survey 2005



Initial Plan

Additional States

United States “Q” Biotype Detections



Solutions

- Communication
- Education
- Cooperation
- Applied Research
- Systems Approach

How Did We Respond?

Efficacy trials on GH ornamentals in CA, GA, FL, and NY

How Did We Respond?

Product (active ingredient)	Number of Experiments (68)	% Control Immatures Avg during 3-5 WAT	
		Foliar	Drench
Aria 50SG (flonicamid)	3	49%	50%
Avid 0.15EC (abamectin)	**5**	80%	-
BotaniGard 22WP/ES (*B. bassiana*)	3	51%	-
BugOil	3	73%	-
Celero 16WG (clothianidin)	3	56%	67%
Distance 0.86EC (pyriproxifen)	3	42%	-
Flagship 25WG (thiamethoxam)	6	56%	8%
Judo 4F (spiromesifen)	**6**	77%	-
Kontos (spirotetramat)	**4**	70%	82%
Marathon II 2F (imidacloprid)	6	28%	57%
M-Pede (K salts of fatty acids)	**3**	79%	-
NoFly (*Paecilomyces fumosoroseus S97*)	3	45%	-
Safari 20SG (dinotefuran)	**10**	86%	91%
Sanmite (pyridaben)	**3**	83%	-
TriStar (acetamiprid)	**7**	90%	-

How Did We Respond?

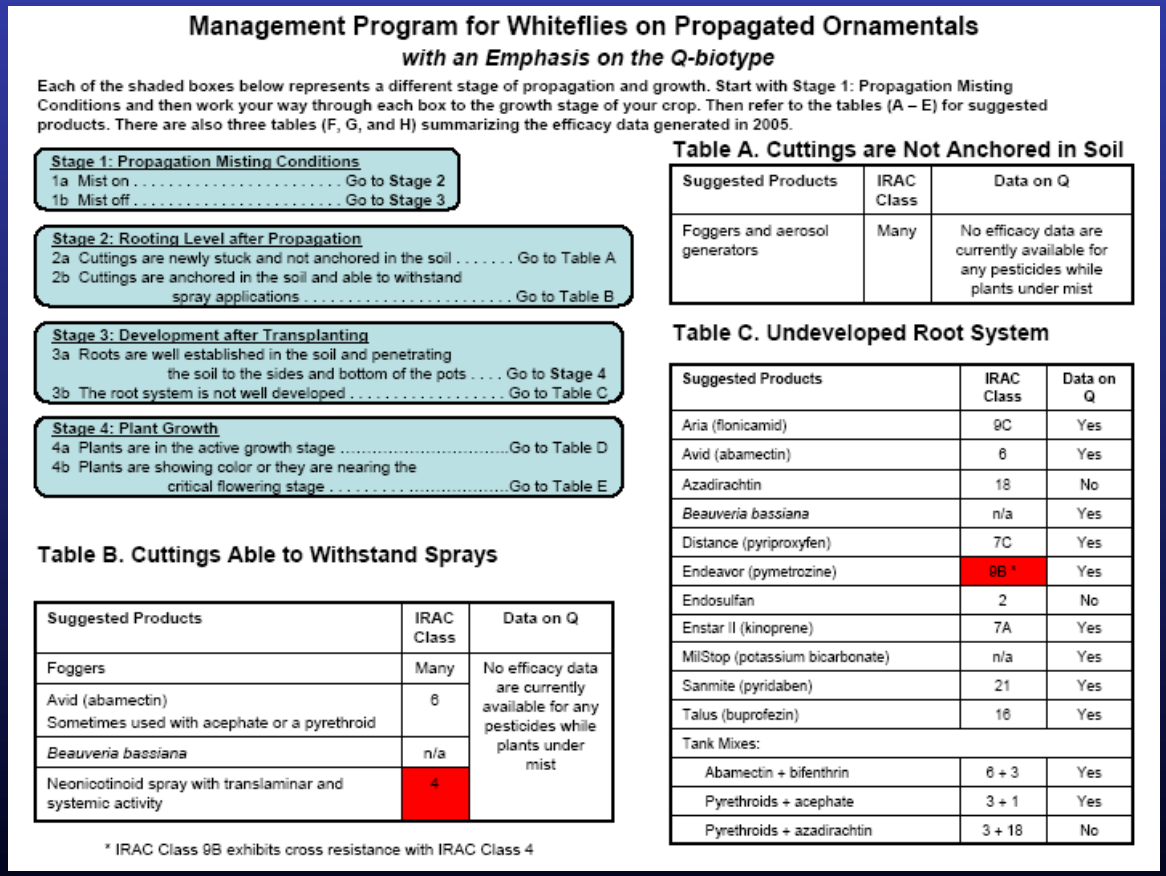
A set of guidelines, "Management Program for Whiteflies on Propagated Ornamentals with an Emphasis on the Q-biotype" was developed for and is being distributed throughout the ornamental industry.

Pest Management Plans

4 (most recent this month)

Funded by:

- IR-4
- USDA-Floral Initiative
- CSREES



Management Program for Whiteflies on Propagated Ornamentals

with an Emphasis on the Q-biotype

Each of the shaded boxes below represents a different stage of propagation and growth. Start with Stage 1: Propagation Misting Conditions and then work your way through each box to the growth stage of your crop. Then refer to the tables (A – E) for suggested products. There are also three tables (F, G, and H) summarizing the efficacy data generated in 2005.

Stage 1: Propagation Misting Conditions
1a Mist on . . . . . Go to Stage 2
1b Mist off . . . . . Go to Stage 3

Stage 2: Rooting Level after Propagation
2a Cuttings are newly stuck and not anchored in the soil . . . . . Go to Table A
2b Cuttings are anchored in the soil and able to withstand spray applications . . . . . Go to Table B

Stage 3: Development after Transplanting
3a Roots are well established in the soil and penetrating the soil to the sides and bottom of the pots . . . . Go to Stage 4
3b The root system is not well developed . . . . . Go to Table C

Stage 4: Plant Growth
4a Plants are in the active growth stage . . . . . Go to Table D
4b Plants are showing color or they are nearing the critical flowering stage . . . . . Go to Table E

Table A. Cuttings are Not Anchored in Soil

Suggested Products	IRAC Class	Data on Q
Foggers and aerosol generators	Many	No efficacy data are currently available for any pesticides while plants under mist

Table B. Cuttings Able to Withstand Sprays

Suggested Products	IRAC Class	Data on Q
Foggers	Many	No efficacy data are currently available for any pesticides while plants under mist
Avid (abamectin) Sometimes used with acephate or a pyrethroid	6	
Beauveria bassiana	n/a	
Neonicotinoid spray with translaminar and systemic activity	4	

* IRAC Class 9B exhibits cross resistance with IRAC Class 4

Table C. Undeveloped Root System

Suggested Products	IRAC Class	Data on Q
Aria (flonicamid)	9C	Yes
Avid (abamectin)	6	Yes
Azadirachtin	18	No
Beauveria bassiana	n/a	Yes
Distance (pyriproxyfen)	7C	Yes
Endeavor (pymetrozine)	9B *	Yes
Endosulfan	2	No
Enstar II (kinoprene)	7A	Yes
MilStop (potassium bicarbonate)	n/a	Yes
Sanmite (pyridaben)	21	Yes
Talus (buprofezin)	16	Yes
Tank Mixes:		
Abamectin + bifenthrin	6 + 3	Yes
Pyrethroids + acephate	3 + 1	Yes
Pyrethroids + azadirachtin	3 + 18	No

How Did We Respond?

WF management information presented at major industry meetings and published in most trade journals.

Websites developed as a means of quashing rumors and disseminating info as it becomes available: http://www.mrec.ifas.ufl.edu/LSO/bemisia/bemisia.htm

Accomplishments-

- Collectively the team had published 6 refereed journal articles, over 40 popular press articles and made over 80 presentations on *Bemisia* biotypes and how to control them. Two whitefly websites were developed and maintained for disseminating whitefly information.

OLD DATA- these numbers have increased significantly!

Accomplishments-

Websites

- Information exchange and educational process
- Removed misunderstandings
- Helped organize the process and business of the Task Force
- Helped to reduce the nature and severity of RUMORS
- Time consuming and difficult to make everyone understand that their input is valued …no ownership issues…

Accomplishments-

- Initially two (US & EU) management programs were developed. Information was transferred to growers for controlling whitefly on propagated ornamentals with an emphasis on biotype Q and plants for planting intended for export. One was circulated to over 10,000 ornamental growers and propagators.

Accomplishments-

Management Program Used to Manage 3 New Invasive Whiteflies in Florida.

Allowed us to manage the new threats. In one case, we implemented an IPM program that resulted in such good control that it is difficult to find the new whitefly.

Q

- Has never been detected in the field.
- We have only had one submission from a tomato plant grown in a greenhouse with ornamentals.

WE AREN'T OUT OF THE WOODS YET!

The detections continue!

Neonicotinoids???

Very Special People
The Brains and Brawn Behind this Program

- Dr. Osama El-Lissy, Deputy Administrator, APHIS-PPQ
- Lin Schmale, Senior director of government relations at the Society of American Florists (SAF)

Collaborator Acknowledgements

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IFAS EXTENSION


SPDN
Southern Plant Diagnostic Network


IPM
Integrated Pest Management
Florida


Fresh from Florida
Division of
PLANT INDUSTRY
Protection through Detection
Florida Department of Agriculture & Consumer Services


APHIS


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Thank you!