

**Project Title:** Statewide survey of the distribution of Q Biotype of *Bemisia tabaci*

**Project Leader:** Xianchun Li

**Project Team Members:** Timothy J. Dennehy and Bruce E. Tabashnik

**Location:** Statewide

### **Critical Issues**

The whitefly *Bemisia tabaci* is one of the world's most destructive and invasive crop pests. A devastating new biotype of this insect, called the Q biotype, originated in Spain and spread to other countries including the U.S. via human-mediated movement of plant materials. Since its first detection in the New World by Dr. Dennehy in Arizona in December 2004, the invasive, insecticide-resistant Q whitefly biotype has been found in 23 other states. So far, it has been detected in the U.S. only on greenhouse-grown herbaceous or ornamental plants. However, like the B biotype in the 1980s, there is the possibility that it could spread to a wide variety of other hosts of whiteflies in Arizona including cotton, melons, and vegetables. If so, it could cause millions of dollars of damage statewide, as did the currently prevalent B biotype. The Q biotype has demonstrated the ability to rapidly evolve resistance to many insecticides, including the insect growth regulators and neonicotinoid insecticides that now control the B biotype in Arizona. Thus, the Q biotype threatens Arizona's crop production.

At this time we don't know for sure the severity of the threat posed by this new biotype. We do know for certain, however, that the introduction of the B biotype devastated IPM programs throughout the Southwest in the 1980s. We do know for certain that the Q biotype strain first detected, Poinsettia'04, had extremely elevated levels of resistance to a broad range of insecticides, relative to B biotype whiteflies in Arizona field crops. Given the possible impact, the only prudent approach to this new threat is to plan for the worst and hope for the best. Planning for the worst requires pro-actively monitoring the location and spread of the Q biotype within our production systems and then exploring ways to manage it before it becomes widely established. To that end, we request that the UA-IPM program contribute partial funding for our surveys of the distribution of the Q biotype throughout the lower deserts and municipal areas of Arizona.

### **Objectives / Activities**

To provide up-to-date information on the distribution of the Q biotype, we will accomplish the following objectives:

- 1) We will sample whiteflies on the following field commodities at locations throughout the lower desert of Arizona: summer cotton and melons, fall melons, winter vegetables (principally Cole crops and leafy greens), spring melons. In addition, we will sample transplants that are hosts of whiteflies at nurseries throughout Arizona. Lastly, during from

Thanksgiving to New Years we will intensively sample poinsettias in retail outlets throughout Arizona.

We cannot predict with accuracy where and when whiteflies will occur on the hosts that we sample. Typically, we find whiteflies on only a very small percentage of winter vegetables and greenhouse crops because these crops are frequently treated with neonicotinoid insecticides. However, our objective will be to obtain a minimum of 10 collections each from cotton, melons, and vegetables (30 total) and 10 collections each from greenhouse-grown transplants and poinsettias (20 total). A sample will constitute a minimum of 10 adult whiteflies.

- 2) Use the mitochondrial cytochrome oxidase I (mtCOI) PCR-RFLP (CAP method) to analyze each sample.
- 3) Validate the Q biotype with either the esterase banding (i.e., allyzome assay) or mtCOI gene sequencing methods
- 4) Integrate the biotyping results into a statewide distribution map of the Q and B biotypes
- 5) Deliver the distribution map to the decision makers/stakeholders and end-users including extension agents, ornamental industry, and growers through the Arizona Cooperative Extension Network (<http://www.ag.arizona.edu/extension/>) and the Arizona Pest management Center (<http://cals.arizona.edu/apmc/>)

This statewide whitefly biotype survey will increase our knowledge and understanding of their statewide distribution, spreading, host crop suitability, and establishment in Arizona. Such information is extremely valuable for the decision makers/stakeholders to assess the severity of the threat posed by this new biotype and the risk of its establishment in Arizona and design rational strategies towards the Q biotype threat accordingly.

### **Relevance to APMC Priorities**

This proposal directly addresses “Pest Detection & Diagnostics” and “Agriculture and Cross-commodity IPM,” two focal areas of the APMC. It also addresses the IPM priorities of “projects that specifically link applied IPM research with statewide outreach.”

### **Inputs/Budget**

Proposed Budget	
Salary	\$6000
Materials & Supplies	\$2000
Total	\$8000

Collections will be made by Tim Dennehy and Ben DeGain of the Extension Arthropod Resistance Management Laboratory (EARML). Laboratory analyses will be conducted by Xianchun Li and PhD student Weihua Ma with the assistance of EARML research technician

Ben Degain. We will use mtCOI gene PCR-RFLP to biotype whitefly samples as our preliminary data has indicated that this method is reliable, fast, and cost-effective. But we will occasionally use the mtCOI gene sequencing or esterase banding pattern to double check the results, especially for the Q biotype.

The total cost of collecting and analyzing whiteflies for this project is estimated to exceed \$30,000. The \$6000 for salary will be used for partial support of PhD student Weihua Ma during 2007. Ben Degain's salary will be funded from other sources. Thus, the \$8000 from APMC will be leveraged with an estimated \$22,000 in funds from other sources.

We will use 2007 funding to: 1) analyze the remaining samples collected from poinsettia in December 2006, 2) collect and analyze new samples in 2007.

### **Outcomes/Impacts**

*Short-term:* Increase in knowledge and understanding of the statewide distribution, spreading, host crop suitability, and establishment of the whitefly Q biotype in Arizona. A distribution map of the Q and B biotypes will be delivered to the decision makers/stakeholders including extension agents, ornamental industry, and growers through the Arizona Cooperative Extension Network and the Arizona Pest management Center

*Medium-term:* Informed assessment of the severity of the threat posed by the Q biotype and the risk of its establishment in Arizona.

*Long-Term:* Design and implementation of rational strategies for management of the Q biotype.

*Evaluation:* We will measure the relative frequency of the B and Q biotypes in terms of locations and crops.

*Outputs: We anticipate the following:* 1) A statewide distribution map of the Q and B biotypes in Arizona; 2) Results communicated to the decision makers/stakeholders and end-users including extension agents, the USDA taskforce on the Q biotype, ornamental industry, and growers; 3) Publication of the survey results and the distribution map.

## Logic Model: Statewide survey on the distribution of Whitefly Biotype Q

SITUATION	INPUTS	OUTPUTS		OUTCOMES- IMPACT		
		Activities	Participation	Short	Medium	Long Term
<p>The devastating Q biotype of the whitefly <i>Bemisia tabaci</i> has been found in 23 states including Arizona. Given the possible impact, the only prudent approach to this new threat is to plan for the worst and hope for the best. Planning for the worst requires pro-actively monitoring the location and spread of the Q biotype within our production systems and then exploring ways to manage it before it becomes widely established.</p>	<p>I am requesting \$ 6000 for partial support of PhD student Weihua Ma during 2007 and \$ 2000 to cover partial cost of Materials and supplies</p>	<p>To provide up-to-date information on the distribution of the Q biotype, we will accomplish the following objectives:                      1) Collect whitefly samples (10 individuals per sample) from different crops (poinsettia, cotton, melon, vegetables, etc.) statewide                      2) Use the mtCOI gene PCR-RFLP to analyze each sample                      3) Validate the Q biotype with mtCOI gene sequencing or esterase banding methods                      4) Integrate the biotyping results into a statewide distribution map of the and Q biotypes                      5) Deliver the distribution map to decision makers / stakeholders and end-users through the Arizona Cooperative Extension Network</p>	<p>Our intended audience is the decision makers/ stakeholders and end-users including extension agents, ornamental industry, and growers of Arizona</p>	<p>Increase in knowledge and understanding of the statewide distribution, spreading, host suitability, and establishment of the Q biotype in Arizona</p>	<p>Informed assessment of the severity of the threat posed by the Q biotype and the risk of its establishment in Arizona</p>	<p>Design and Implementation of rational strategies for management of the Q biotype</p>