Outstanding Achievements in Team Research:

Investigating the Q Invasion - Distribution of *Bemisia tabaci* Biotypes in Florida

After the 2004 discovery of the *Bemisia tabaci* (Gennadius) Q biotype in the U.S., there was an urgent need to determine its distribution. As part of a coordinated country-wide effort, this team of entomologists conducted an extensive survey of *B. tabaci* biotypes in Florida, with the cooperation of growers, state, and federal agencies, to monitor the introduction and distribution of both the B and Q biotypes to aid growers in their management decisions.

During the past 4 years, biotype Q has been detected in 25 states across the country including Florida. Indistinguishable in appearance from silverleaf whitefly (*B. tabaci* biotype B), biotype Q is extremely problematic to agricultural production because it has a high propensity to develop resistance to insect growth regulators (IGRs) and neonicotinoid insecticides. Both classes of insecticides play crucial roles in controlling whiteflies in many different cropping systems including vegetables and ornamentals. Growers were encouraged to biotype their whitefly populations so they would know whether IGRs and certain neonicotinoid insecticides would be effective in their individual spray programs. The biotype status of submitted *B. tabaci* samples was determined by PCR amplification and sequencing of a ~750 bp mitochondrial cytochrome oxidase I small subunit (mtCOI) gene fragment, PCR amplification and size determination of two unique microsatellite markers and esterase zymogram analysis.

Extensive whitefly surveys were conducted from 2005–2008 from multiple locations across Florida representing 23 different counties and 34 different host plants. One hundred and eighty collections were taken and of these samples, 58% were from vegetables, 37% were from ornamentals and 5% were from peanuts, alfalfa and weeds. A total of 2,372 individual whiteflies were analyzed by mtCOI and microsatellite markers. Of those individuals, 1,944 (82%) individuals from 168 collections were biotype B and 428 (18%) individuals from 32 collections were biotype Q.

When biotype Q was detected, 34% of the samples were from collections containing a mix of both biotypes. Biotype B was detected in 23 counties and on all hosts sampled except hydrangea; however hydrangea was only sampled on one occasion. Biotype Q was detected in six counties, all of which were on ornamentals and herbs in greenhouses indicating biotype Q had not invaded field-grown vegetables. There was great concern among growers and researchers alike that biotype Q would make the jump from protected ornamental greenhouse production to open agriculture.

In Florida, tomato transplants for field production can be grown in the same greenhouses that grow a variety of ornamental plants so there were opportunities for biotype Q to infest tomato transplants destined for the field. We surveyed 13 preferred whitefly field-grown vegetable hosts in 14 counties and did not detect biotype Q in any of the samples. Some counties had more than one positive Q sample, but in no case, did the Q biotype continue to spread and all populations were managed with no new finds since the summer of 2006. The extent of the problem and diligent efforts by growers to implement the suggested best management practices for the control of this pest led to the reduction of growers experiencing control problems which has drastically declined.

The number of submissions for whitefly biotype determination has continued to decline these past two years. Sequence comparison of the mtCOI gene identified three separate haplotypes within Florida that could be used to associate populations known to be related by grower and plant type thereby tracking distribution routes. For example, collections in five counties were made on hibiscus linked to the same grower and all samples contained only the Q1 haplotype. Other populations contained a mix of the Q2 and Q3 haplotypes supporting the conclusion that the Q biotype must have entered Florida through at least two separate introductions. Our data also show that two microsatellite markers are a cost effective diagnostic alternative for biotype identification with 100% concurrence with mtCOI sequence data. Development and application of these genetic tools provided evidence that there was no hybridization between the two whitefly biotypes which occur in Florida.

Growers have also shown their willingness to adopt suggested best management practices when presented with these findings, combining both research and industry efforts to reduce losses from whitefly pests. Because of the concerted effort by all those involved, growers have been provided with a management plan to prevent the Q biotype from establishing within their cropping systems. And more significantly, the implementation of this management plan by growers will now ensure that plant material being distributed from grower establishments will not be contaminated with Q biotype insects, thereby lessening the likelihood that the insect will transfer over to vegetable and field crops.

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