# INSECTICIDE RESISTANCE IN *Bemisia tabaci:* A PERSONAL PERSPECTIVE

Nick C. Toscano

Department of Entomology, University of California, Riverside, CA 92521, USA

Pesticides have improved agriculture and human health immensely by controlling pests and vectors for more than half a century. However, many target pests have developed resistance mechanisms that enable them to avoid or reduce the lethal effects of pesticides. The proliferation of resistant pests is one of the primary problems limiting agricultural productivity and the quality of human health. It is critical to understand the nature of resistance and the steps that can be taken to avoid or delay it. This is especially important in the case of major pests such as *Bemisia tabaci* which has a well documented history of developing insecticide resistance to most major classes of chemistry. Resistance to organophosphates and pyrethroids in *B.* tabaci was reported during the 1980s in Sudan and California at a time when fewer classes of insecticides were being used. The rate of resistance development to insecticides in target pests including *B. tabaci* varies based on the genetics, biological/ecological and operational factors. The importance of some of these factors on the status of insecticide resistance in *B. tabaci* from different parts of the world will be considered in this topic.

During the 1990s, a biotype shift occurred in North America that resulted in significant ecological differences between the former the newer biotypes. The replacement biotype was a more severe pest that infested not only cotton, but also other field crops such as alfalfa, spring and fall melons, and fall leafy vegetables. A resistance-monitoring program was initiated in Imperial Valley, CA, in 1993 to determine the relative susceptibilities of whiteflies to the various insecticides that were being used on crops year round. Results of five years of intensive monitoring data revealed no progression towards resistance development to bifenthrin, endosulfan, chlorpyrifos and methomyl in spite of heavy use of these compounds. In general, whiteflies appeared to be less sensitive in 1993 compared to the next 2-3 years as indicated by lower $LC_{50}$s, thus suggesting that whiteflies were more susceptible in subsequent years even after intense exposure. These results indicated that responses of whiteflies to insecticides were dynamic, but not necessarily progressive towards higher resistance levels. A number of factors that may have influenced avoidance towards resistance increase will be discussed.

Imidacloprid, a neonicotinoid, was used heavily to combat whiteflies since 1994. Comparative monitoring data for three neonicotinoids, acetamiprid, imidacloprid and thiamethoxam in 1999 and 2000 showed variations from field to field, however, the $LC_{50}$ values were extremely low, (<10 ppm) and gave no indication of reduced activity. A comparison of whitefly responses from Guatemala and Almeria to imidacloprid were reported to be less sensitive. A number of factors including agro-ecosystem, insecticide use patterns and refuges, that may have influenced susceptibility patterns to various insecticides in whiteflies from different parts of the world are compared.