CHAPTER 3.14

Conclusions and Recommendations

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Despite over 40 years of research on *Bemisia tabaci* (Gennadius) (Homoptera:Aleyrodidae) as a pest and vector of plant viruses, this whitefly species continues to cause considerable damage to food and industrial crops in Mexico, Central America and the Caribbean. *B. tabaci* first became a pest of cotton (*Gossypium hirsutum* L.) in Middle America, and then a major vector of plant viruses in common bean (*Phaseolus vulgaris* L.) and tomato (*Lycopersicon esculentum* Mill.) plantings throughout the region. The expansion of non-traditional crops in the 1980s, mainly vegetables for export, further aggravated the problem by providing more reproductive hosts for the whitefly pest and a higher demand for pesticides. The introduction in the early 1990s of a more aggressive and polyphagous biotype (B) of *B. tabaci* in the Americas further jeopardized past efforts to control this pest.

In this region, whitefly-borne geminiviruses (begomoviruses) are more prevalent during the dry months of the year (November through April), when *B. tabaci* populations encounter more favourable weather. The area planted to crops such as melon (*Cucumis melo* L.), common bean, tomato, eggplant (*Solanum melongena* L.), cucurbits and sweet and hot peppers (*Capsicum* spp. L.) has been reduced greatly or completely abandoned during this period of the year because of the frequent outbreaks of whiteflies and whitefly-borne viruses. The development of *B. tabaci* from a harmless insect to a major pest is closely related to the introduction and intensive use of pesticides after the Second World War. Pesticide abuse remains a major factor in *B. tabaci* and begomovirus epidemics in this region. Whiteflies are known to develop resistance to insecticides, the frequent use of which eliminates natural predators of *B. tabaci*. It is not uncommon to see farmers spraying insecticides on susceptible crops every other day and even daily, up until harvest time, in open defiance of food safety regulations. The high levels of pesticide residues in tomato, pepper, common bean, eggplant and other vegetables attacked by *B. tabaci* disqualifies these products for sale in international markets and constitutes a serious health hazard for the millions of rural and urban consumers in the region, where produce is not tested for toxic residues.

But the main reason for the persistence of these pest problems is the lack of qualified technical assistance for farmers, particularly

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those who have attempted to diversify their subsistence crops with more profitable cash crops such as tomato and pepper. This situation is a reflection of the increasingly deteriorating economic situation of the region since the mid 1970s, which has negatively impacted on the capacity of national agricultural research institutions and international agricultural research centres to conduct research and provide the necessary technical assistance to farmers affected by severe phytosanitary problems such as whiteflies and begomoviruses. Moreover, the diversion of foreign aid funds from crop improvement to natural resource management has further contributed to increased yield losses due to pest problems, abandonment of profitable crops grown by small-scale farmers, higher production costs and considerably more environmental and food contamination.

Whitefly and begomovirus control strategies in the region differ according to countries, agricultural areas and crops. In north-western Mexico, the use of virus-resistant common bean varieties and more efficient insecticides for vegetables has greatly reduced the impact of these pests. In the Yucatán Peninsula, Mexico, small-scale farmers were using physical control methods during the first 3 weeks after transplant of tomato and pepper. In the Dominican Republic, a crop-free period was legally imposed throughout the country to break the cycle of the whitefly before the main planting season. And in most Central American countries, susceptible crops were only planted during the rainy season, when whitefly populations are at their lowest level. These whitefly/virus control strategies have reduced, but not eliminated, the production losses associated with outbreaks of *B. tabaci* due to various factors. The constant flow of improved cultivars developed in the past through conventional plant breeding methods has been greatly reduced because of the radical changes that have occurred in the past decade in favour of molecular breeding methods. Second, technical assistance to small-scale farmers is practically nil, which leaves plant protection in the hands of pesticide salespeople. Susceptible crop-free periods reduce whitefly incidence but do not increase the productivity of prime agricultural land that must be devoted to less profitable crops or remain idle during several months of the year. The new insecticides in the market are effective for whitefly control but are very expensive for resource-poor farmers.

The Tropical Whitefly Integrated Pest Management (TWF-IPM) Project has successfully identified, tested and validated the most efficient and sustainable whitefly control methods used in over 10 countries in Middle America. So far, the most valuable IPM measure identified is genetic resistance to control whitefly-transmitted viruses, particularly in the case of common bean. Unfortunately, practically no crop improvement work is being done in the case of vegetables such as tomato and pepper despite their tropical American origin. Most vegetable varieties are bred in temperate countries and thus are not adapted to the tropical conditions and pests that exist in the region. The TWF-IPM Project has successfully used physical barriers (micro-tunnels) to protect sensitive crops during the first critical month of their life cycle. This strategy also protects susceptible plants against other insect-borne viruses and pests, and greatly increases their productivity per unit area with minimum inputs. The identification and use of bio-control agents of *B. tabaci* has been advanced

greatly in the region, particularly in countries such as Cuba and the Dominican Republic. Finally, an enhanced understanding of the whitefly species, biotypes and plant viruses present in the region, has helped understand the ecology and epidemiology of these crop production problems and, more important, has contributed to the implementation of sustainable and efficient IPM methods.

It is imperative to re-orient agricultural research in the region by understanding that spending our limited resources on purely environmental or sociological issues, without a food production component, only perpetuates misery and increases environmental degradation and human health problems. There is considerable need to strengthen national and international research and extension services to provide timely and effective technical assistance to small-scale farmers. We must help resource-poor farmers to diversify their cropping systems with more profitable crops in order to maximize the income derived from their limited land resources. Traditional crops are the basis of food security but they are merely subsistence crops. High-value crops, particularly vegetable and fruit crops, can help small-scale farmers improve their livelihoods but this can only be achieved with proper and timely technical assistance provided by multi-disciplinary groups of agricultural specialists. Finally, there is a vacuum in the area of agricultural economics and marketing for small-scale farmers. Unless these farmers are incorporated into the market chains, they will be at the mercy of the vagaries of the open markets and intermediaries who profit from the misery and lack of market knowledge of the resource-poor farmer. The TWF-IPM Project expects to address these issues and scale up the dissemination of the IPM measures validated to date in Central America, Mexico and the Caribbean region.

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