

Promoting scientific information exchange to combat the whitefly menace

Whitefly management and control

DURING THE PAST DECADES, whiteflies have risen in notoriety as important plant pest species particularly of horticultural crops. While previously, insecticides managed to control sporadic pest infestations and the diseases they transmit, new uncontrollable outbreaks have become serious cause for concern. Huge agricultural losses have prompted many scientists and researchers to investigate the causes of and find solutions to this new phenomenon.

Along with the rapidly advancing technological development in horticulture worldwide, a single group of insect species has turned out to be its gravest threat — the whitefly, particularly the *Bemisia* sp. Whiteflies pose a high pest status on a wide range of host plants and the damages it currently inflicts globally are incalculable. Crop losses, noticeably in greenhouse or protective cultivated horticultural crops, ornamentals and flowers, as well as crops grown in open fields, are caused through direct feeding damage or through transmission of decimating plant viruses. Whiteflies have been widely reported causing crop damage in most subtropical and tropical regions of the world. With increasing movement of plant material and produce among countries, there are unavoidable risks for whitefly and associated viruses to spread to new areas.

General interest in whiteflies stimulated numerous published documents and collection of literature on *Bemisia* as aid to researchers, educators, extension personnel, agricultural producers, industry, and government officials to find solutions against an ever growing list of whitefly-transmitted virus species that jeopardize crop production. In the Asian and Pacific region, experts believe that this problem can only be more effectively resolved by forging regional cooperation, particularly by maintaining an efficient flow of information on whitefly research, crop protection studies, and pest management practices through proactive updating and sharing of practical information of all sources. Investigations on whiteflies have now reached a stage at which significant applicable technologies can result from mutual exchange of information among nations.

Forum for scientific information exchange

The international seminar on whitefly management and control strategy was organized to create opportunities for the advancement and sharing of information to enable the crop protection sector to effectively keep track and control whitefly pest species and plant diseases from spreading to new crops and locations.

Amid this era of globalization and trade liberalization, the seminar proved to be very timely and fitting. Now, every country must share the common cause of finding innovative solutions in such areas as crop protection, not only to cope with indigenous agricultural pests, but also to be aware of the risk and impact of alien invasive species such as whiteflies and its various species and biotypes. This potential threat is gaining more and more attention in view of the ever-increasing menace in the movement of alien invasive species across national borders, brought about by increased activities in worldwide trade and travel.

In the past three decades or so, the upsurge in whitefly severity has prompted scientists and extension workers worldwide to find ways to control this pest. The most common whiteflies are the greenhouse whitefly (*Trialeurodes vaporariorum*), sweetpotato whitefly (*Bemisia tabaci*), and the silverleaf whitefly (*Bemisia argentifolii*). On top of the notorious list, however, is the tiny silverleaf whitefly, which causes far more damage than



Photos courtesy of S.W. Lee, NIAST, RDA, Korea

Whitefly damage on bellpepper production in the greenhouse

its size suggests it could. It feeds on many crops and costs growers severe economic losses each year. Several new species and viruses spread by this pest have been found in many Asian countries. These newly invading whiteflies are apparently brought about by increasing movement of plant materials and produce among national borders. They have quickly become serious insect pests in the region, often causing high crop losses through direct feeding damage or through transmission of decimating plant viruses.

During the seminar, distinguished experts representing nine countries in the Asian region shared and exchanged rich knowledge and experience on whitefly-related research and development works. The scientific inputs provided by the speakers are vital toward a better understanding of the current situation of whitefly occurrence, crop protection studies, and pest management and control practices in the region, toward coming up with focused programs and action plans that would lead to improved and sustained crop protection against whitefly pest species and plant diseases.

Understanding the genetic characteristic of the whitefly

Bemisia tabaci (Hemiptera: Aleyrodidae) is a haplo-diploid species of sap feeding insect belonging to the group of insects commonly known as whiteflies. From earlier analyses of mitochondrial and ribosomal markers, it has been concluded that in the Asian and Pacific region there were three major indigenous races as well as a large collection of genotypes with no clear association with any race.

However, recent research using microsatellites has demonstrated that *B. tabaci* from the Asian and Pacific region may be split into six genetic populations with little or no gene flow between them. These bear only superficial similarity to the mitochondrial and ribosomal defined races.

Moreover, four of the six can be further split into two subpopulations which again show little evidence gene flow between them. While the patterns reflect a strong geographic structure, physical barriers alone cannot explain all the observed structure. Differential host plant utilization explained some of the substructure, but could not explain the overall structure. The roles of mating interference and Wolbachia in developing the genetic structure are considered.

The lack of gene flow between genetic populations and some subpopulations further suggests that the barriers were either sufficiently impermeable to immigration or that reproductive isolation and competitive interactions were sufficiently strong to prevent gene flow. If the latter is the case, it suggests that there may be as many as 10 morphologically indistinguishable species indigenous to the Asian and Pacific region.

Management and control strategy

The escalating whitefly problem has led to an increased use of insecticides, which not only put pressure on the environment, but has led to resistance problems. Also, the various whitefly species and biotypes look very much alike, but they have subtle physiological differences. These differences can cause them to respond differently to

control strategies. Because control measures must be selected according to the type of whitefly present, accurate identification is critical to successful control.

Today, using an integrated, environment-friendly, and sustainable control strategy against whiteflies is the biggest challenge. Neither chemical, biological nor cultural controls used singly have controlled whitefly where it has become predominant pest in field or greenhouse crops. However, the integration of several control tactics can be effective in reducing the overall impact of this pest, and may lead to an acceptably low level of whitefly infestation.

During the seminar, some of the important considerations pointed out by the speakers in terms of coming up with an integrated whitefly control include: knowing which plants are affected by whiteflies and understanding the nature of its damage to crops; the biology of the whiteflies and their natural enemies; and how to monitor whitefly populations such as sites, population dynamics, and action thresholds. Also, it is important to know the limitations of various control tactics, which include cultural controls such as altered planting practices and physical barriers, host plant resistance, chemical controls, and natural controls.

Looking ahead

The major output of the seminar is a compilation of relevant and timely practical and technical information that will surely help countries in the Asian region cope with the major damages brought about by whitefly infestation. A total of 15 papers were presented during the seminar, all outcomes of years of research and scientific investigation, and represent a great contribution to the advancement of agricultural science, particularly in the area of crop protection. The papers, which will be disseminated by FFTC through its various publication lines, embody the state-of-the-art in whiteflies as pests and vectors of plant viruses in Asia, and which will be useful to researchers, extension specialists, and policymakers for the better management and control of the pest.

Whiteflies have been reported and continue to maintain a high pest status causing severe damage in most temperate and subtropical regions. Hence, countries within the Asian and Pacific region must be able to establish a systematic mechanism for the sharing and exchange of knowledge, information and technology. As new whitefly species and viruses spread into and within the Asian and Pacific region due to the increase in globalization and



Officials of the Miaoli District Agricultural Research and Extension Station in north central Taiwan brief the participants of their bio-control research and extension works for crop production.

trade liberalization with increasing movement of plant materials and produces among countries, new problems are to be expected. The tiny whiteflies will not only cause crop losses within a country but also will become a potential alien invasive species across national borders.

For all its intent and purposes, this seminar was able to provide all the participating countries with first hand information on recent advances in Asia in the area of crop protection toward effectively controlling whiteflies in the region. Finally, it is envisioned that the activity will pave the way toward improving the flow of information and effecting a better understanding of the control and management of whitefly pests and the diseases they transmit.

International Seminar on Whitefly Management and Control Strategy

Held at the Agricultural Research Institute (ARI), Taichung, Taiwan ROC on October 03-08

Countries represented: 9 (Australia, Indonesia, Japan, Korea, Malaysia, Philippines, Taiwan ROC, Thailand, Vietnam)

Papers presented: 16

Participants: 70

Cosponsors: Bureau of Animal and Plant Health Inspection Quarantine (BAPHIQ); Agricultural Research Institute (ARI)

List of papers

Keynote paper

1. *Bemisia tabaci*, from molecular to landscape
- Paul De Barro, CSIRO Entomology, Australia



Participants of the seminar observe pest management practices for horticultural crops in Nantou country, central Taiwan.

Resource papers

2. Diversity of geminiviruses of tomato and weeds in Asia
 - Sylvia K. Green, AVRDC- The World Vegetable Center, Taiwan ROC
 3. Molecular characterization of tomato yellow leaf curl virus and related whitefly-transmitted geminiviruses in Japan
 - Masatoshi Onuki, JIRCAS, Okinawa Subtropical Station, Japan
 4. Management of whitefly for commercial tomato production in greenhouses in Shizuoka, Japan
 - Keitaro Sugiyama, Shizuoka Agricultural Experiment Station, Japan
 5. Whitefly-transmitted geminiviruses in ornamental plants and their control strategies in Taiwan
 - Ying-Huey Cheng, ARI, Taiwan ROC
 6. Survey of whiteflies status and their transmission of plant viruses in Taiwan
 - Chiun-Cheng Ko, NTU, Taiwan ROC
- Country reports*
7. Review on the biology of *Bemisia* whiteflies and their virus transmission in Japan
 - Kenichiro Honda, National Institute of Vegetable and Tea Science, Japan
 8. Management of whiteflies of economic importance in Thailand
 - Banpot Napompet, Kasetsart University, Thailand
 9. Current developments of whitefly management in the Philippines
 - Jocelyn E. Eusebio, PCARRD, Philippines
 10. Whitefly occurrence, state and control strategy in Korea
 - Si-Woo Lee, NIAST, RDA, Korea
 11. Research on biology and ecology of whitefly, *Bemisia* sp, in Vietnam
 - Tran Dinh Pha, National Institute of Plant Protection, Vietnam
 12. Whitefly and its control in Indonesia
 - Wiwin Setiawati, Indonesian Vegetables Research Institute, Indonesia
 13. Status of whitefly as plant pest and virus vector in vegetable and prospects for control in Malaysia
 - Mohamad Roff Mohd Noor, MARDI, Malaysia
 14. Occurrence of whiteflies and their integrated management in Taiwan
 - Feng-Chyi Lin, ARI, Taiwan ROC
 15. Technology transfer through information dissemination: FFTC in the sustainable agriculture partnership
 - Cristina Bejosano-Gloria, FFTC, Taiwan ROC

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