Asia-Pacific
Economic Cooperation

Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access

APEC Agricultural Technical Cooperation Working Group

December 2007

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Published for
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APEC#207-AT-04.5

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1. BACKGROUND INFORMATION

Leafminers, whiteflies, thrips and mealybugs are serious and widespread agricultural pest problems in the region, becoming increasingly more important over the last five years. Leafminers attack numerous vegetable crops and are particularly important pests for beans (especially long bean), cucumber (also some other cucurbits), potato, tomato and crucifers (e.g. cabbage). It has been reported that whitefly (*Bemicia tabaci*) damage and virus disease transmission on vegetables have increased significantly in the last five years. Whitefly problems on fruit trees have also been reported. Thrips are now common throughout the tropical areas of Southeast Asia, and are also found in other parts of the world. Thrips species infesting agricultural crops pose difficult problems to developing economies in terms of market access. Mealybugs can cause severe damage to agricultural crops. For example, the pink hibiscus mealybug can infest, reproduce, and cause severe damage on over 200 genera in 70 different families of plants, including cotton, citrus, many vegetables, grapes, ornamentals, and other species of major importance to agriculture in many APEC economies. It has been estimated that the mealybug's potential cost to U.S. agriculture is US$750 million per annum.

APEC economies are, to a certain extent, aware of the importance of these pests. For example, many species of leafminers, whiteflies, thrips and mealybugs appear on the Northern Australian Quarantine Strategy (NAQS) priority list.

However, for developing economies in-country expertise and information is largely lacking. This deficiency of knowledge has serious implications to both national plant protection and plant quarantine management. In particular, it would not be possible to know which species to exclude upon plant quarantine inspection, and there would be no in-country expertise to identify these pests on plant imports.

2. PROJECT STRUCTURE

The APEC Project on "Capacity Building in Surveillance & Diagnosis for Leafminer, Whitefly, Thrips & Mealybug Pests in Developing APEC Economies for Improved Market Access" was conceived as a two-year project (ATC 01/2006A & ATC 01/2007A).

The Project objectives were to:

- Create awareness in developing APEC economies to the problems caused by leafminer, whitefly, thrips and mealybug pests as constraints to productivity and trade, and the need to generate adequate plant health information necessary under the new global trading environment to help improve rural livelihoods and reduce poverty of farmers through higher quality produce and better market access.
- Improve skills among national plant protection and quarantine officers to detect the presence and extent of these pests in their country and to reduce the economic impacts caused by the outbreak of such pests,
- Build capacity of and cooperation between member economies to implement pest surveillance programs for building information on the health status of vegetable and ornamental industries, particularly with respect to these pests, to maintain and secure market access. The commonality of interest in these pests practically paves the way for greater economic and technical cooperation, a major APEC MAPA objective.

The project ATC 01/2006A consisted of:

- Phase I: Planning Workshop to develop common surveillance protocols.
- Phase II: In-country surveillance and collection.

The planned Year-2 Project (ACT01/2007A) would address the identification of specimens collected from participating economies during their surveys.

3. PLANNING WORKSHOP TO DEVELOP COMMON SURVEILLANCE PROTOCOLS

A 5-day planning workshop was organised at Corus Hotel, Kuala Lumpur, Malaysia from 22-25 May 2006 and was attended by 17 participants from 9 member economies and 8 resource persons. Twenty four observers from different institutions in Malaysia also participated in the workshop (**Attachment A**). The programme of the workshop is given as **Attachment B**.

The agenda for the five-day workshop was structured around the following topics:

1. Reports on the status of the target pests from participating economies (**Attachment C-K**).
2. An overview of the Department of Agriculture, Fisheries and Forestry (DAFF) Australia Surveillance Toolkit, including:
    - Designing surveys: types and definitions
    - Getting started
    - Methods for choosing survey sites
    - Calculating sample size
    - Timing and data to be collected
    - Collecting specimens
    - Data storage, people and permits
3. Designing protocols for surveying the target pests
4. Sign-off of protocols and plans of action for each participating economy

The ACIAR publication 'Guidelines for Surveillance for Plant Pests in Asia and the Pacific', served as the basis for deriving the protocols for each targeted pest group (leafminers, whiteflies, thrips and mealybugs). The relevant International Standard for Phytosanitary Measures (ISPM) on pest surveillance details the requirements but not the steps needed to perform the surveys. The ACIAR publication, developed by DAFF Australia in consultation with regional plant health professionals, is a step-by-step guide on how to carry out pest surveillance according to ISPM standards and is a useful tool for developing economies that are embarking on such surveillance programs for the first time. An electronic version of the publication can be down-loaded from http://www.aciar.org

During the working group discussions to design survey protocols for the different targeted pest group the following observations and issues emerged:

- Strong commitment from all participants to ensure the proper implementation of the surveillance
- Active participation of all participants in developing the protocols

- Some economies lack funds to implement pest surveillance for specific crops
- No standard protocols for implementing surveillance and monitoring in most economies
- Lack of staff to conduct surveillance and lack of proper facilities to keep and maintain collected specimens
- Lack of expertise to properly identify the collected specimens
- Most of the existing collections are old and not adequately described (according to ISPM standards)
- Most of the collection are not properly identified

In general, the planning workshop achieved its objectives and served to:

1) Create awareness and build/enhance/increase capacity in the participating economies to design surveillance programs for building information on the health status of agricultural industries and native flora and for early detection of serious exotic pests. Pest surveillance is an integral component of governmental/industry/pest specific biosecurity plans for supporting trade in agricultural commodities;
2) Build wide understanding of, and share information on, the need for participating economies to engage in biosecurity planning as a means of containing transboundary movement of exotic pests and to mitigate damage and losses caused by invasive pests and diseases that do cross sovereign borders;
3) Build capacity of participating economies to respond to exotic pests to reduce economic impacts caused by incursions and outbreaks of such invasive; and
4) Strengthen capacity of participating economies to implement SPS measures in compliance to the requirements of the WTO SPS Agreement.

4. IN-COUNTRY SURVEILLANCE AND SPECIMEN COLLECTION

Following the successful conclusion of the planning workshop during which common surveillance protocols were agreed upon, participants returned home to implement a surveillance and collection programme for leafminers, mealybugs, thrips and whiteflies. This was conducted by each participating economy from June 2006 till February 2007.

Following the protocols developed in Phase I, each participating economy was partially supported by project funds to conduct a survey for the target pests. Participants were provided with some small equipment items and the project consultants made mentoring visits to each participating economy to assist in monitoring and advising on the implementation of the survey.

Mentoring visits were conducted by project consultants to participating economies to provide support in project activities, such as planning surveillance, selecting the target crops, collecting and preparing specimens for identification, etc.

Overall, the survey activities for these four groups of plant pests progressed well and there were no serious problems. Surveys for these pests were carried out and specimens collected from vegetables and citrus (Brunei), leafy and fruit vegetables (China), field crops (Chinese Taipei), mango (Indonesia), cut flowers, fruits and vegetables (Malaysia and The Philippines), cut flowers and vegetables (Singapore), basil leaves (Thailand) and chrysanthemum and citrus (Viet Nam). The report of the mentoring visits are given as **Attachment L-T**.

The collected specimens would be used for identification workshops in Year-2 Project (ACT01/2007A).

The mentoring visits showed that:

- Most economies were able to carry out the surveillance programme for the targeted pests planned under the project
- Most economies were able to harness available national capacity for the planned activities. However, the availability of GIS and access to database software is lacking and would benefit national surveillance programmes in many cases.
- Most economies managed to build a good collection of specimens of the targeted pests as a direct result of the project.

5. LESSON LEARNT FROM THE PROJECT

Useful lessons have been learnt for future activities

Synergistic cooperation between APEC economies, regular monitoring by the project overseer and steering committee of the project as well as the expertise and full commitment of the consultants were very important elements for the successful implementation of the project.

The support and cooperation of co-sponsoring APEC Economies, from concept planning to implementation, are important elements in ensuring that project objectives are fully met. Project objectives that are truly aligned with the needs of developing APEC economies assured good response and active participation. While the project was conceptualized largely by developing APEC economies, co-sponsoring economies included developed APEC economies as well. This assured useful contributions from the latter, such as the ACIAR 'Guidelines for Surveillance for Plant Pests in Asia and the Pacific'. As the project emphasized capacity-building, participation from developed APEC economies was realized in the form of resource persons.

Important observations emerged from interactions encouraged during the project; some of these provide very useful pointers for further development assistance, as they will be able to build on the capacity-building carried out in this project.

Gender Considerations

The Project Overseer is a lady and the Steering & Organising Committees consisted of a significant number of women (five), equivalent to about 47%., 12 participants of the workshop were women (24 %). The almost equal gender representation contributed positively to the overall objectives of the APEC Programme.

Participation

The participants, speakers, panelists and consultants of this project represented NPPOs, academia, agricultural research institutions and NGOs, covering a wide spectrum of stakeholders, with relevant knowledge and experience of surveillance issues and the species of the four targeted pests.

Financing

While careful budget planning assured the overall smooth implementation of the project, APEC rules on disbursement presented some difficulties for participants from some member economies who were unable to pay for their expenses ahead of re-imbursement after the workshop and other project activities. Although this was overcome through advancement of funds by the Consultants after securing approval from APEC Secretariat, it nevertheless represented an unexpected intervention. It is hoped that the APEC Secretariat can, in future, consider disbursement of per diem and traveling expenses for designated eligible participants to be managed by the appointed accordingly on behalf of APEC.

6. NEXT STEPS

In general terms, the project successfully addressed a subject of great relevance to developing economies of APEC, and that is the pressing need to generate plant health status information through pest surveillance to ISPM standards to meet market access requirements under the TWO Agreement. All participants agreed that the project has successfully has achieved its objectives by creating awareness to the problems caused by the four selected pest groups: leafminers, whiteflies, thrips and mealybugs; improving their skills to detect the presence and extent of these pests in their economy; and building their capacity to implement pest surveillance programmes for building information on the health status of their vegetable and ornamental industries.

Implementation of this project provided an insight into appropriate approaches to plant health capacity-building for developing economies. Experience gained from this project suggest that capacity-building by example, drawing on real issues that confront developing economies represent perhaps the most fitting approach to knowledge and skills transfer; participants can perceive real gains right from the start.

All participants also endorsed the follow-up activities proposed under a Year-2 of this Project (ATC 01/2007A) as essential for building up a complete package of skills to describe plant health status of specific crop commodities. These include:

- Re-entry workshops to provide the opportunity for participants to come back together:
    a. to review their experiences in the implementation of the pest surveys
    b. to carry out hands-on comparison of collected specimens of the target pests and verification of the identities by participants alongside taxonomic experts
- Discuss the establishment of a specimen collection programme in each economy together with the requisite information for these pests and diseases of agricultural importance
- Apply the resources gathered from these surveys to generate pest lists for vegetables and horticultural crops of importance to their individual economies
- Consider and plan the way forward for systematic national level “monitoring surveys” for the targeted pest groups, proceeding subsequently to other pests and diseases of importance based on knowledge gained from this project.

Other suggestions that emerged from this project that deserve APEC-wide consideration include:

a. setting up a Regional Plant Pest Specimen Collection Centre for APEC member economies as part of a networking initiative to foster effective exchange of specimens and related information among APEC member economies for mutual benefit.

b. establishing a regional portal on specimen collection information and related databases in support of animal and plant health as well as food safety,

c. holding regular workshops on to build diagnostic skills on key pests of importance to intra-APEC trade.

d. consideration by developed APEC economies to provide support for the greater use of ICT in agriculture for developing economies, particularly with respect to market access preparedness.

Attachment A

APEC PLANNING WORKSHOP IN SURVEILLANCE AND DIAGNOSIS
22 - 25 MAY 2006
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Attachment B

Asia-Pacific Economic Cooperation

Government of Malaysia

PROGRAMME

APEC Planning Workshop on Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access

22 – 25 May, 2006
The Corus Hotel, Kuala Lumpur, Malaysia

Programme

Sunday, 21st May

09.00 – 17.00	Arrival of participants
20.00 – 22.00	Welcome Dinner hosted by the Department of Agriculture, Malaysia

Monday, 22nd May

08.15 – 09.00	Registration
09.00 – 09.30	Opening Ceremony
09.30 – 09.45	Group Photos
09.45 – 10.30	**Refreshments**
	SESSION I – Chairperson:
	Ms Wan Normah Wan Ismail (DOA)
10.30– 11.00	Overview of the project (*Loke Wai Hong, CABI-SEARC*)
11.00 – 11.30	Regional overview on the status of the target pest groups (*Liz Asteraki, CABI-SEARC*)
11.30 – 13.00	Country presentations on surveillance: availability of methods for different crops/pests, regularity, etc. (10 minutes per country) *Brunei, China, Chinese Taipei, Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam*
13.00 – 14.00	**Lunch**
	SESSION II – Chairperson:
	Dr Loke Wai Hong (CABI-SEARC)
14.00 – 14.45	Why survey for plant pests? (*Graeme Evans, Australia*)
14.45 – 15.15	ISPM standards relevant to surveillance (*Lum Keng Yeang, CABI-SEARC*)
15.15 – 15.45	**Refreshments**
15.45 – 17.15	The 21 Steps of the ACIAR-DAFF surveillance manual (*Graeme Evans, Australia*)

Tuesday, 23rd May

	SESSION III – Chairperson:
	Mr Yusof Othman (DOA)
08.00 – 08.50	Experiences and outcomes from other regional workshops (*Graeme Evans, Australia*)
08.50 – 10.30	Case studies of key species from the 4 taxonomic groups: • Leafminer (*A. Sivapragasam, MARDI*) • Thrips (*Liz Asteraki, CABI-SEARC*) • Whitefly (*Loke Wai Hong, CABI-SEARC*) • Mealybug (*Lim Guan Soon, CABI-SEARC*)
10.30 – 11.00	**Refreshments**

11.00 – 12.00	Working Group Discussion I: Development of draft protocol for leafminers (*facilitated by Liz Asteraki, Lim Guan Soon & A. Sivapragasam*)
12.00 – 12.45	Plenary presentation and discussion on the draft protocol for leafminers
12.45 – 14.00	**Lunch**
14.00 – 15.00	Working Group Discussion II: Development of draft protocol for whiteflies (*facilitated by Liz Asteraki, Lim Guan Soon & A. Sivapragasam*)
15.00 – 15.45	Plenary presentation and discussion on the draft protocol for whiteflies
15.45 – 16.00	**Refreshments**
16.00 – 17.00	Working Group Discussion III: Development of draft protocol for thrips (*facilitated by Liz Asteraki, Lim Guan Soon & A. Sivapragasam*)
17.00 – 17.45	Plenary presentation and discussion on the draft protocol for thrips

Wednesday, 24th May

08.00 – 09.00	Travel to Agriculture Extension Training Institute of DOA (ILPP, Serdang)
09.00 – 10.30	Field trip to fruit orchard to test draft protocols (*facilitated by Yusof Othman*)
10.30 – 11.00	**Refreshments**
11.00 – 12.00	Working Group Discussion IV: Development of draft protocol for mealybugs (*facilitated by Liz Asteraki, Lim Guan Soon & A. Sivapragasam*)
12.00 – 12.30	Plenary presentation and discussion on the draft protocol for mealybugs
12.30 – 14.00	**Lunch**
14.00 – 17.00	Visit to Putrajaya
17.00	Return to Corus Hotel

Thursday, 25th May

	SESSION IV – Chairperson: Dr Graeme Evans
	Presentation of draft protocols and discussion
08.30 – 08.50	Leafminer (*Lum Keng Yeang*)
08.50 – 09.10	Whitefly (*Loke Wai Hong*)
09.10 – 09.30	Thrips (*Liz Asteraki*)
09.30 – 09.50	Mealybug (*Lim Guan Soon*)
09.50 – 10.20	General Discussion
10.20 – 10.40	**Coffee/Tea**
	SESSION V - Chairperson: Dr Soetikno S.S. (CABI-SEARC)
10.40 – 11.25	Preservation techniques for the 4 taxonomic groups (*Yusof Othman, DOA*)
11.25 – 12.10	What happens next? (*Lum Keng Yeang & Graeme Evans*)

CLOSING SESSION

12.15 – 13.00	Closing Remarks and Certificate presentation (*Wan Normah Wan Ismail*)
13.00 – 14.00	**Lunch**

Friday, 26th May

Departure of participants

ORGANIZING COMMITTEE

1. Mr Mat Hassan Othman, Department of Agriculture, MALAYSIA
2. Ms Jamaliah Puteh, Department of Agriculture, MALAYSIA
3. Ms. Azizah Md Jan, Department of Agriculture, MALAYSIA
4. Dr Loke Wai Hong, CABI-SEARC
5. Dr Lum Keng Yeang, CABI-SEARC
6. Dr Soetikno S. Sastroutomo, CABI-SEARC
7. Mr Yusof Othman, Department of Agriculture, MALAYSIA
8. Ms Wong Wan Cheng, Department of Agriculture, MALAYSIA
9. Mr Arizal Arshad, Department of Agriculture, MALAYSIA
10. Ms Rohaizah Mohd Nasir, Department of Agriculture, MALAYSIA

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Assistant Secretary
International Section
Strategic Planning & International Division
Ministry of Agriculture and Agro-based Industry, Malaysia

APEC Planning Workshop on
Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access
May 22-25, 2006
Kuala Lumpur, Malaysia

PEST STATUS REPORT

The Status of White fly, Mealybugs, Leafminer and Thrips Pest in Brunei Darussalam

Hj Mohd Sofian bin Hj Muhd Za'im [1]

Introduction

Brunei Darussalam lies on the northwest coast of Borneo Island where it faces the South China Sea with a land area of 5,765 square kilometers with the population about 390,000. The main export of the country is oil and gas. The country is now embarking on a diversification program that emphasizes in industry and commerce. This move is in recognition of the fact that oil and gas are non-renewable commodities. In line with this diversification program, Brunei has drawn up an Industrial Development Plan by actively promoting foreign investments involving four sectors namely Manufacturing, Primary Resources, Services and Human Resources.

The primary resources sector includes agriculture (poultry, fruits and vegetables, and floriculture), fishery, forestry (which includes the fields of eco-tourism and biotechnology) and integrated production like poultry, farming and product processing.

The agriculture sector's contribution to country's Gross Domestic Product (GDP) has shown an increasing trend in the past two years with poultry industry being the main sectors. While in crop industry, the Agriculture Department's statistics on agricultural production revealed that vegetable and ornamental plants recorded local production levels of over 50% self-sufficiency.

To increase the agriculture contribution to the GDP as well as responding to the food security programs, Crop Development Division, Department of Agriculture has been given the trust to promote crop's industry development.

One of the impediments to the sustainable production of high quality crop produce was the lack of knowledge and skill in pest and disease taxonomy and identification which is considered to be the key factor in promoting and implementing effective and safer pest management program.

Human resource development and capacity building program pest and disease management was an area of priority of Crop Protection Unit, Crop Development Division to effectively respond to the pest management expertise and advisory services to the farmers.

1. Senior Veterinary Assistant, Plant Pest Unit, Brunei Agriculture Research Centre Kilanas, Department of Agriculture, Ministry of Industry and Primary Resource.

Crop Protection Unit which comprises of three unit namely Plant Pest Unit, Plant Pathology and Plant Quarantine Unit were actively participate training, seminar and workshops both at national level as well as regional and international as part of its commitment to strengthen its human resources development in the field crop pest control and management capacity building program.

Pests Status

The establishment of Plant Pest Unit in 1972 with it's main function to provide taxonomic and identification, expertise and advisory as well as recommendation of control and management services to farmers has collected and compiled arthropods pest of agriculture importance as reference to respond to the farmer's problems associated with the pest.

The collection of arthropod pests, the data and information available was a result of routine on going program through farm visit, pest survey, field collection and specimens received for entomological investigation.

Due to lack of human resources with the skill and expertise on pest-surveillance the unit concerned were unable to carry out regular national pest-surveillance program on these 4 groups of insect as well as other insect with the expectation of rice pest and fruit fly pest. Thus there has not been any national surveillance protocol being design or developed specifically for these insect groups.

However based on our observation the occurrence of these 4 insect groups on agricultural crops in Brunei Darussalam was regarded as the pest of significant economic importance and therefore required proper management to minimise their damaging effects.

Following is the status of the 4 insect groups namely White fly, Mealybugs, Leaf miner and Thrips and their significant importance on agricultural production in Brunei Darussalam.

WHITE FLY

They are five species of white flies had been identified and recorded in Brunei.

Order : HEMIPTERA Family : Aleyrodidae

Genus spp.	**Host**
1. *Aleurocanthus spiniferus*	*Citrus reticulata*
2. *Aleurotuberculatus* sp.	*Jasminum* sp.
	Capsicum annuum
3. *Aleurocanthus* sp.	*Punica granatum*
4. *Neomaskellia bergii*	*Saccharum officinarum*
5. *Trialeurodes* sp.	*Sauropus albicans*

Based on 3 years record on sample received from the extension staffs for pests identification as part of the Plant Pest Unit's program on providing taxonomic and

identification services and pest monitoring have shown that White fly (family Aleyrodidae) problems are predominantly occurred on vegetable crops: cucumber, luffah, brinjal, hot pepper, pumpkin and quava.

The damage caused by this insect pest mainly concentrated in the underside of the leaves causing mottling of the infected leaves. In severe infestation when the population of white fly is very high, it was observed that the present of ants which attracted to the honeydew secreted by this pest caused secondary disease infection of sooty mould.

MEALYBUGS

They are nine species of mealybugs that have been identified and recorded in Brunei were:-

Order : HEMIPTERA Family : Pseudococcidae

Genus spp.	**Host**
1. *Dysmicoccus brevipes*	*Ananas comosus*
2. *Pseudococcus obscurus*	*Capsicum annuum*
3. *Pseudococcus citriculus*	*Citrus* spp.
4. *Planococcus citri*	*Codiaeum* sp.
	Mussaenda erythrophylla
	Nephelium lappaceum
	Theobroma cacao
5. *Ferrisia virgata*	*Euphobia pulcherrima*
	Gliricidia maculata
6. *Planococcus* sp.	*Clerodendron thomsoni*
	Luffa acutangula
	Nephelium lappaceum
7. *Rastrococcus spinosus*	*Mangifera indica*
8. *Maconellicoccus hirsutus*	*Mimosa pudica*
9. *P. lilacinus*	*Nephelium lappaceum*
	Theobroma cacao
	Apium graveolens
	Psophocarpus tetragonolobus

Based on three years record only few samples received from the extension officers on mealybugs (family Pseudococcidae) problem; that is on flower and local fruit (Pulasan, *Nephelium mutabile*, on stem and tarap, *Atocarpus odoratissimus*, on leaves). Controlling ants can help reduce mealybug numbers. They are transported between plants by ants attracted to honeydew. They tend to congregate on stems and leaves and in leaf axils. Individual bugs are often concealed in white, woolly “nests”. They can attack almost any plant, causing leaves to yellow and wither rapidly and they also excrete “honeydew” which attracts ants. Severe infestation can result in total loss of leaves.

LEAF MINER

There is one species of leafminer identified and recorded in Brunei.

Order : DIPTERA Family : Agromyzidae

Genus spp.	**Host**
1. *Ophiomyia phaseoli*	*Vigna sesquipedalis* *V. unguiculata*

The leafminers (family Agromyzidae) mine through leaves to produce a range of symptoms. Many leafminers are specific to certain plants and have their own entries. The leafminers are sap-sucking grubs that tunnel through leaves between the surfaces, creating an irregular white pattern which is usually long and narrow. The grubs can often be seen if leaves are examined closely. To control, pick off affected leaves and use an appropriate pesticide spray.

Based on three years record on leafminers damage from the extension worker were particularly on Luffah, long bean, egg plant and tomato. There have been reports on farm visit on long beans severely affected by the leafminers on few farm in Brunei. The farmers were advised to destroy and burn the affected crops and practice crop rotation.

THRIPS

There is one species of thrips identified and recorded in Brunei.

Order : THYSANOPTERA Family : Thripidae

Genus spp.	**Host**
1. *Thrips palmi*	*Citrullus lanatus* *Vigna sesquipedalis*

Based on the three years record, there were many samples received on thrips damage from the extension officers. They were on chili, egg plant, long bean, ladies finger, tomato, orchid flower and watermelon.

Thrips are sap suckers, colored yellow, green and black. They seldom fly and are more likely to jump. Thrips can attack any fairly soft foliage, causing a silvery discoloration and they also attack flowers and fruits and affected a wide range of plants including some plants grown under glass. They can spread certain plant viruses. To control, remove spoiled flowers and badly damaged leaves, then spray plants with an appropriate pesticides.

Conclusions

Pest surveillance is no doubt a very important activity in order to determine the status of pest and its economic significant in agricultural industry. Well planned surveillance with properly designed protocol together with good diagnostic knowledge and skill are therefore important tools in preventing pest infestation and economic loss of agricultural crop.

APEC Planning Workshop on
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May 22-25, 2006
Kuala Lumpur, Malaysia

Pests Status of Whitefly, Leaf miner, Thrips and Mealybug in China

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Whiteflies, leaf miners, thrips and mealy bugs are important agricultural pests in many Asia-Pacific countries including China. They caused large damage and loss on vegetables, fruits, ornamentals as well as forests since the decade. Due to abuse of insecticides on these pests, their resistances to chemicals develop rapidly and the incorporation of non-insecticide measures is seen as a key step in achieving long term sustainable management of these pests. Here we report the status of these four pests in China that developed in the last 10 years.

1 Whitefly

1.1 Species and Distribution

There were about 1200 whitefly species in the world (Mound & Halsey, 1978), and about 170 species in China (Yan & Li, 2000). In spite of the wide variety of cropping systems affected by whiteflies and their diverse life histories, only few whiteflies are important pests, including *Bemisia tabaci* (Gennadius), *Trialeurodes vaporariorum* (Westwood), *Aleurocanthus spiniferus* (Quaintance), *Dialeurodes citri* (Ashmead), *Pealius mori* (Takahashi), *Aleurocybotus indicus* David & Subramaniam and *Bemisia afer* (Priesner & Hosny) etc. Of these species, *Bemisia tabaci* and *Trialeurodes vaporariorum* regularly cause damage in annual cropping systems.

Although *B. tabaci* Gennadius was described from Greece (Gennadius, 1889), it probably originated in India or Pakistan (Mound, 1983). The presence of *B. tabaci* was recorded in China for the first time in 1949 (Chou, 1949). Up to 1996, it had been reported as a pest of cotton, vegetable and ornamental crops in 13 provinces (EMPPO, 1993; Xu, 1996). Now *B. tabaci* B biotype was recorded in all provinces except Tibet.

Trialeurodes vaporariorum was originated in Brazil and Mexico. Then it was introduced to North America and Europe. The presence of *T. vaporariorum* was recorded in China for the first time in 1940s (Yang, 1981). Now it had been

reported as a greenhouse pest in 20 provinces, North China, and sometimes it also has found in South China.

1.2 Host Plants and Economic Impact

1.2.1 *Bemisia tabaci*

According to the field investigation, *B*. *tabaci* has been recorded on over 280 cultivated and wild host plants in Guangzhou (Qiu *et al* . 2001), Jiangsu (Zhou *et al.*, 2003) and Fujian areas (He *et al.*, 2003), and the host plants of *B*. *tabaci* are still increasing.

At present, *B. tabaci* has reached the overall status of a major pest on vegetables and ornamentals, both outdoors and under protected cultivation. In greenhouses, it may occur year round and mainly affects vegetables and flowers. Although severe damage of *B. tabaci* was limiting production of tomato as early as the 1960s in Guangzhou (Ke *et al.*, 1965), it has long been known as a relatively unimportant agricultural pest. The outbreaks of *B. tabaci* populations are known in greenhouses from 1999 in Guangdong (Wang et al., 1999) and from 2000 in Beijing (Luo *et al.*, 2000). Outdoors it is a major pest of summer crops such as vegetables, including Cucurbitaceae, Solanaceae, and Crucifereae. It attracted attention as a pest on ornamentals and causes particularly severe damage on poinsettia and hibiscus in public gardens and road dividers.

Bemisia tabaci transmit plant viruses such as geminivirus, which can be extremely virulent. In China *B. tabaci* is known to transmit at least 5 plant viruses: tomato yellow leaf curl virus (TYLCV), tomato leaf curl virus (TomLCV), tobacco leaf curl virus (TbLCV), squash leaf curl virus (SqLCV-C), sweet potato leaf curl virus (SPLCV).

TomLCV is one of major problems affecting tomato production in many tropical and subtropical countries. The disease has been reported widely, with losses as high as 75 percent. The disease were found in Chinese Taipei in 1987 (Green and Sulyo, 1987) and in Guangxi in 1991 (Cai *et al.*, 1995). The virus was transmitted by grafting and by *B. tabaci*, but not mechanically. One single viruliferous whitefly was able to transmit the virus after 48 hours' feeding time on an infected plant. When groups of five and ten whiteflies were used, the transmission rate of the virus was 70 percent (Green and Sulyo, 1987).

Another severely TYLCV was found in some tomato fields in Guangzhou, Guangdong in the early 1960s (Ke *et al.*, 1965) and the disease incidence reached 30-50% and 16-85% in 1961, 1963, respectively. TYLCV was also reported in Chinese Taipei in 1981(AVRDC, 1984).

TbLCV was reported in Guangxi, Yunnan, Fujian, Guangdong, Chinese Taipei (Gong et al., 1982). Tobacco leaf curl disease was found in nine counties of Guangxi, in general, only a few tobacco plant was infected, but in some places, the disease incidence reached more than 50 percent, and caused great damage to the production of tobacco (Cai *et al*., 1993).

1.2.2 *Trialeurodes vaporariorum*

According to the investigation in greenhouse and fields, *T. vaporariorum* has

been recorded on over 900 cultivated and wild host plants of 121 families in China (Li et al., 1980; Wong, 1994; Liao et al., 2001). Although it was recorded in 1940s, the outbreaks of *T. vaporariorum* populations in greenhouse are known in 1976 in Beijing. It was gradually replaced by *bemisia tabaci* from early in 2000s.

2 Leaf Miner

2.1 Species and Distribution

The species of leaf miner in China are more than 10 species, including *Liriomyza artemisicala, L. lutea, L. compositella, L. Pusilla, L. chinensis, L. congesta, L. brassicae, L. bryoniae , L. sativae* and *L. huidobrensis* etc. *Liriomyza sativae* Blanchard was first found on vegetables in Hainan province in 1993, shortly after that *L. huidobrensis* Blanchard was found in Yunnan province, and leaf miners have been reported in more than 20 provinces.

2.2 Host Plant and Economic Impact

Leaf miners have wide host range, for example, *L. sativae* can feed on bean, beet, carrot, celery, cucumber, eggplant, lettuce, melon, onion, pea, pepper, potato, squash, and tomato. *L. huidobrensis* can damage more than 50 host plants in 14 families in China. The exact number of host plants of leaf miners in China is not ascertained.

Leaf miners can reduce the reproduction of crops either in greenhouse or open fields, the average damage cause by these pests were usually 30-50% of crop yield, and the loss caused by *L. sativae* in Sichuan province in 1996 was more than 300 millions.

3 Thrips

3.1 Species and Distribution

The main species of thrips on vegetables are *Hydatothrips heteraurus* Han, *Ayyaria chaetophora* Karny, *Megalurothrips typicus* Bagnall, T*aeniothrips glycines* Okanoto,*Thrips palmi* Karny, *Haplothrips tenuipennis* Bagnall and *Frankliniella occidentalis* (Pergande), etc. Of these vegetable thrips, *Thrips palmi* was very important pest. In recent years melon thrips has spread from Southeast Asia to most of the rest of Asia, and to many Pacific Ocean islands, North Africa, Australia, Central and South America, and the Caribbean. In China it was first observed in Chinese Taipei in 1970s, Then it was recorded in Guangdong, Guangxi, Hunan and Yunnan in 1976 and Hubei, Zhejiang, Jiangshu, Shanghai, Anhui, Hebei, Shandong, Liaoling in 1990s.

Frankliniella occidentalis, one of the most important quarantine pests in the world, was also recorded in some greenhouses in Beijing in 2003.

3.2 Host plant and Economic impact

Thrips palmi is a polyphagous species, but is best known as a pest of

Cucurbitaceae and Solanaceae. Among vegetables injured are bean, cabbage, cantaloupe, chili, Chinese cabbage, cowpea, cucumber, eggplant, lettuce, melon, okra, onion, pea, pepper, potato, pumpkin, squash, and watermelon. Cucurbits were more suitable than eggplant, whereas pepper was less suitable than eggplant(Tsai *et al*.,1995). It had become a serious pest of many varieties of cultivated vegetables from 1980s, and in recent years, increasing population tread of the pest was observed from 1990s (Zhang *et al*., 1985; Chen *et al*., 1998; Lu *et a*l., 1999; Gu *et al*., 2000)

4. Mealy bug

4.1 Species and Distribution

The main species of mealy bugs on vegetables and fruits are *Planococcus citri* Risso, *Pseudococcus fragilis* Brain, *Dysmicoccus brevipes* Cocrerell, *Maconellicoccus hirsutus* (Green). Loblolly pine mealybug, *Oracella acuta* spread to Taishan city of Guangdong province along with plant materials from Georgia of America in 1988, and it was first found in Hongling Seed Orchard of Taishan city in June of 1990. Subsequently it was put in the quarantine pest list of China in 1992. At present, *O. acuta* distributes in Guangdong, Guangxi and Fujian provinces in China.

4.2 Host Plant and Economic Impact

Oracella acuta attacks *Pinus* trees such as *P. elliottii*, *P. taeda*, *P. caribaea*, *P. massoniana* etc. in China. Among them, *P. elliottii* is the most susceptible to the scales. *O. acuta* mainly damages the tender top of pine tree, living on sucking liquid from pine trees. In the situation of severe damage, the scale results in treetop bend, shrink, resinosis, and lower volume augment. At the same time, the pine cones will be runtish, small and curve. By 2002, distribution area and the damage area of *O. acuta* are 377 thousands and 140 thousands hm^2 respectively.

APEC Planning Workshop on Surveillance

Kuala Lumpur, Malaysia
22-25 May 2006

	Please give most important species			**What crops most affected by species**		
	Species 1	**Species 2**	**Species 3**	**Crop 1**	**Crop 2**	**Crop 3**
Leaf miner	*Liriomyza sativae*	*L. huidobrensis*		vegetables		
Whiteflies	***Bemisia tabaci***	***Trialeurodes vaporariorum***		vegetables	ornamentals	
Mealy bug	*Oracella acuta*			*Pinus* trees		
Thrips	*Thrips palmi*	*Frankliniella occidentalis*		Cucurbitaceae	Solanaceae	

APEC Planning Workshop on
Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access
May 22-25, 2006

ECONOMY REPORT – CHINESE TAIPEI

Available species, Distribution, Crops Affected, Detection and Monitoring of Whitefly, Mealybugs, Leafminers and Thrips in Chinese Taipei

Chern-Feng Yen
Specialist, Plant Protection Department,
Bureau of Animal and Plant Health Inspection and Quarantine,
Council of Agriculture, Executive Yuan, Chinese Taipei

1. Introduction

With the trends of liberalization and globalization, international trade and traveling have become more frequent than before. The risk of introducing exotic plant pests following different pathways increases significantly. In the past decades, we have suffered from enormous economic and environmental losses caused by invasive plant pests, such as the American serpentine leafminer and silverleaf whitefly. As we gained access to the WTO in January, 2002, it is important for us to ensure that new trade opportunities benefit us without creating new threats from harmful exotic pests. In order to balance these risks with our enjoyment of a wide variety of agricultural products, we put much effort in identifying potential pathways for plants pests and take phytosanitary measures based on sound principles of science. Furthermore, we take action to detect and monitor invasive plant pests with high introduction likelihood and try to contain or eradicate the ones that have already entered and established in restricted areas.

2.Available Species, Distribution and Crops Affected of the 4 Groups Pests (Whitefly, Mealybugs, Leafminers and Thrips)

To safeguard the agricultural products, the population dynamics of important pests have been posted on the plant pest monitoring system every 10 to 30 days and waring alert is issued in case the severity of diseases or insect population is over the economic threshold. Therefore the farmers can effectively control the pests in Chinese Taipei. The available species, distribution and crops affected of whitefly, mealybugs, leafminers and thrips in Chinese Taipei are listed in Table 1.

3. Institutions Dealing with the Detection and Monitoring Survey

3.1 Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ)

The Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ) is the top authority of animal and plant quarantine and protection. In order to prevent the introduction and extension of exotic plant pests, BAPHIQ is responsible for administration and coordination of detection, monitoring and management of plant pests. There are four branch offices of BAPHIQ set up in Keelung, Hsinchu, Taichung and Kaohsiung where international airports or harbors are located. The branch offices are responsible for carrying out the detection of exotic plant pests.

3.2 Institution other than BAPHIQ

Several institutions collaborate in detection, monitoring and diagnosis of plant pests in Chinese Taipei. Their responsibilities are as follows:

3.2.1 Identification Centers: In order to identify the plant pests as early as possible, five identification centers funded by BAPHIQ were set up at Taiwan Agriculture Research Institute (TARI), National Taiwan University, National Chung Hsing University, National Chiayi University and National Pingtung University of Science and Technology. These centers consist of as many as 40 experts specialized in taxonomy of insects, plant pathogens, and other plant pests. As soon as the pest species is identified, the report is sent to BAPHIQ and appropriate action is taken according to PRA and expert judgment. We have established CompuServe of Taiwan Agricultural Pests to provide correct and real-time information.

3.2.2. Crop Pest Diagnosis Service Stations：30 crop pest diagnosis centers were set up at various agricultural organizations under COA, such as TARI, Taiwan Agricultural Chemicals and Toxic Substances Research Institute (TACTRI), Taiwan Banana Research Institute, Taiwan Tea Experiment Station, district agricultural improvement stations and department of plant protection at universities. These centers provide farmers and the general public with plant disorder diagnosis services and recommend solutions to the problems affecting plant health.

3.2.3. Regional Pest Monitoring Centers：In order to keep in check the status of existing key plant pests in different areas in Chinese Taipei, eight regional pest monitoring centers were established at eight district agricultural improvement stations. Plant protection specialists at these centers periodically conduct surveys to determine the population fluctuation of designated insect pests and the severity of certain major crop diseases. Data are immediately sent through plant pests monitoring system to the information center located at TACTRI and then distributed to related institutions. The control center, located at BAPHIQ, is responsible for analyzing the data and taking appropriate action.

4. Implementation of Detection and Monitoring of Plant Pests

4.1 Detection Survey

4.1.1 Nationwide Detection Survey Program on Exotic Insect Pests

For early detection and prompt response, BAPHIQ developed an nationwide network comprising

1,015 trapping sites that are located in high-risk areas such as ports of entry, places of production, essential passages, and markets of agricultural products. The details of survey are listed in Table 2. Currently, over 100 well-trained plant protection officers are responsible for trap replacement, specimen collection, and preliminary screening, and 6 designated taxonomists are in charge of confirmatory identification of the collected specimens. All the data are recorded and compiled in the plant pest monitoring system.

4.1.2 Detection Survey on Exotic Pathogens/Insect Pests/Weeds

Several quarantine pathogens, insect pests, and weeds that pose high risk are also under detection survey initiated by BAPHIQ and conducted by different research institutions. The methods used are extensive sampling of suspicious host plant materials or cultivation medium followed by detection, examination, or identification depending on the traits of target pests. The exotic pests of surveys are

bulb mite, banana bract mosaic virus, plum pox virus, golden nematode and etc.

4.2 Monitoring Survey

In addition to the detection survey program for exotic pests, routine surveillance of 4 existing key crop pests, oriental fruit fly, melon fly, tobacco cutworm and beet army worm, is conducted by Taiwan Agriculture Research Institute (TARI). Besides, some other 42 plant pathogens and insect pestsare are also put under surveillance program, such as the causal agents of melon thrips, chillie thrips on lotus, chillie thrips on tea, silverleaf whitefly, rice water weevil, and etc.

5.National Surveillance Protocols

To determine locations of surveillance sites, sampling techniques and survey methods, BAPHIQ has published guidelines for standard operating procedures, such as guideline for detection survey of plant quarantine pests.

6.Conclusion

Located in the subtropical area, Chinese Taipei has warm and humid climate that is favorable for the establishment and spread of a wide variety of plant pests, therefore it is extremely important for us to prevent the introduction of exotic pests by international trade, traveling, and other activities. Being aware of the significance of pest surveillance, BAPHIQ has put great emphasis in planning, supporting and coordinating related research and extension programs since its establishment in 1998. Still, a lot of job need to be done, such as:

1. Establish sound and feasible domestic regulations for detection and monitoring survey of pests.
2. Strengthen the implementation of quarantine at points of entry.
3. Promote technical cooperation and information sharing with other economy members and work in close collaboration to prevent the spread of dangerous pests around different regions.

Table 1. Available species, distribution and crops affected of whitefly, mealybugs, leafminers and thrips

Group	Available species in Chinese Taipei	Distribution in Chinese Taipei	Crops affected
Leafminer	1.American serpentine leafminer (*Liriomyza trifolii*)	nationwide	gerbera, chrysanthemum, tomato and etc.
	2.Vegetable leafminer (*Liriomyza sativae*)	nationwide	melon, cucumber, tomato, French bean and etc.
	3.Serpentine leafminer (*Liriomyza huidobrensis*)	nationwide	crucifer and etc.
	4.Pea leafminer (*Chromatomyia horticola*)	nationwide	pea and etc.
Whitefly	1.Silverleaf whitefly (*Bemisia argentifolii*) (*Bemisia tabaci*) type B	nationwide	melon, cauliflower, poinsettia, tomato, cucumber, Texas blue bell, eggplant and etc.
	2.Spiraling whitefly (*Aleurodicus dispersus*)	nationwide	guava, cherimoya, papaya, banana and etc.
	3. Nesting whitefly (*Paraleyrodes bondari*)	the southern part	guava, wax apple, citrus and etc.
Mealybug	1. Pacific mealybug (*Planococcus minor*)	nationwide	guava, citrus, shaddock and etc.
		the eastern part	cherimoya
	2. Pineapple mealy bug (*Dysmicoccus brevipes*)	the central and southern part	pineapple, banana, cherimoya and etc.
	3.Citrus mealybug (*Planococcus citri*)	nationwide	citrus, shaddock and etc.
Thrips	1.Melon thrips (*Thrips palmi*)	nationwide	eggplant, pepper, melon, bean and etc.
	2.Flower thrips (*Frankliniella intonsa*)	nationwide	rose, chrysanthemum and etc.
	3.Hawaiian flower thrips (*Thrips hawaiiensis*)	nationwide	banana, rose, citrus, chrysanthemum and etc.
	4.Chillie thrips (*Scirtothrips dorsalis*)	nationwide	citrus, mango, lotus, peanut, tea and etc.

Table 2. Nation-wide detection surveys of exotic insect pests in Chinese Taipei

Target pest	Type of trap	Attractant	Survey frequency	No. of trap
Codling moth (*Cydia pomonella*)	Wing trap	Pheromone	Every 2 wks	1,015
Mediterranean fruit fly (*Ceratitis capitata*)	Jackson trap	Attractant (Trimedlure)	Every 2 wks	1,015
7 Fruit flies (Guava fruit fly and etc.)	McPhail trap	Methyl eugenol	Every 2 wks	1,015
Queensland fruit fly (*Bactrocera tryoni*)	McPhail trap	Cuelure	Every 2 wks	1,015
9 Fruit flies (Mexican fruit fly and etc.)	Yellow sticky card	—	Every 2 wks	1,015
Western flower thrip (*Frankliniella occidentalis*)	Blue sticky card	—	Every 2 wks	400

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Group	Please give most important species			What crops most affected by species		
	Species 1	**Species 2**	**Species 3**	**Crop 1**	**Crop 2**	**Crop 3**
Leafminer	American serpentine leafminer (*Liriomyza trifolii*)	vegetable lafminer (*Liriomyza sativae*	serpentine leafminer (*Liriomyza huidobrensis*)	gerbera	melon	French bean
Whiteflies	silverleaf whitefly (*Bemisia argentifolii*)	spiraling whitefly (*Aleurodicus dispersus*)	nesting whitefly (*Paraleyrodes bondari*)	melon	tomato	guava
Mealybug	Pacific mealybug (*Planococcus minor*)	pineapple mealy bug (*Dysmicoccus brevipes*)	citrus mealybug (*Planococcus citri*)	guava	pineapple	citrus
Thrips	melon thrips (*Thrips palmi*)	flower thrips (*Frankliniella intonsa*)	Hawaiian flower thrips (*Thrips hawaiiensis*)	eggplant	chrysanthemum	rose

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Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access
May 22-25, 2006
Kuala Lumpur, Malaysia

PEST STATUS REPORT IN INDONESIA: Leafminers, Whiteflies, Thrips and Mealybugs

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SUMMARY

Leafminers, *Liriomyza* spp (Diptera: Agromyzidae), currently become serious pests of vegetables in Indonesia. It was first reported in September 1994 attacking potato at Cisarua, Bogor. Now, the pest attack many kinds of vegetable in Java, Sumatra, Kalimantan and Sulawesi. The fly attacks the plants by mining the leaves, which makes the leaves dry and fall down. The pest can reduce production up to 45% - 100%. There are at least three species found in Indonesia: *Liriomyza huidobrensis, Liriomyza sativae,* and *Liriomyza chinensis. Liriomyza huidobrensis* mostly attack potato and other vegetables in high elevation areas, *Liriomyza chinensis* attack onion, and. *Liriomyza sativae* attack Cucurbitaceae, Solanaceae and other vegetables in lower land areas.

Whiteflies (Hemiptera: Aleyrodidiae) commonly attack many kinds of vegetables causing injury of plants as well as distributing plant viral diseases. Damages caused by viral diseases distributing by the pests usually are more serious than injurious caused by the insects themselves. As an illustration, a gemini virus disease on tomato or chili can causes 100% damages. There are at least three species of whiteflies commonly found in vegetables in Indonesia: *Bemisia tabaci, Aleurodicus dispersus*, *Dialeurodes* sp., and *Trialeurodes vaporariorum*. *Bemisia tabaci* is the most important species of whiteflies in Indonesia as this insect cause the Yellow Disease in chili plantation across Indonesia in the last few years. The common hosts of the pests are cassava, tomato, chili, and soybean.

Thrips (Thysanoptera) can be found in many kinds of vegetables, fruits, and ornamental plants. It suspected as a vector of viral diseases in papaya and chili. There is only a very few information of this pest in Indonesia.

Mealybugs (Hemiptera: Pseudococcidae) are very common pests in vegetables, fruits, and palms. In the last few years, pineaple pink mealybug, *Dismicoccus brevipes* is one of the important pest in pineapple. This insect is believed as a vector of a serious viral disease in pineapple.

Before 1999, there was a system where pest observers from all districts in Indonesia reported the pests and their populations in monthly bases. At this time, there is neither effective system nor standard for surveillance and diagnosis of these pests in Indonesia. The new system and standard for surveillance and diagnosis of pests in Indonesia need to be established.

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	Please give most important species			**What crops most affected by species**		
	Species 1	**Species 2**	**Species 3**	**Crop 1**	**Crop 2**	**Crop 3**
Leaf miner	*Liriomyza huidobrensis*	*Liriomyza sativae*	*Liriomyza chinensis*	Solanaceae (potato)	Cucurbitaceae	Onion
Whiteflies	*Bemicia tabaci*	*Trialeurodes vaporariorum*	*Aleurodes sp.*	Chili pepper	Tomato	Cassava
Mealy bug	*Planococcus citri*	*Ferrisia virgata*	*Dysmicoccus brevipes*	Coffee, citrus	Guava	Pine apple
Thrips	*Trips tabaci*	*Trips palmi?*		Chili pepper	Onion	

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Malaysia Country Report

A. SPECIES NAMES & KNOWN HOST

Leafminers found in Malaysia

Species	Host
Liriomyza strigata	Cucurbit
Chromatomyia	Ornamental
Phyllocnistis citrella	Citrus
Agromyza phaseoli	Phaseolus vulgaris
Phytomza atricornis	Pisum sativum
Liriomyza brassicae	Brassica juncea

Whitefly found in Malaysia

Species	Host
Aleurodicus disperses	Guava
Bemisia tabaci	Tomato
Bemisia argentifolii	Egg plant
Aleurocanthus yusopei	Cocos nucifera
Aleurotrachelus lumpurensis	Nephelium lappaceum
Aleurotrachelus sp.	Theobroma cacao

Mealy bug

Species	Host
Planococcus citri	Citrus
Dymiscoccuss brevipes	Pineapple
Pseudococcus longispinus	Sweet potato
Phenacoccus iceryoides	Citrus spp Ornamental
Phenacoccus longispinus	Manihot utilissima
Tylopcoccus sp.	Manggo

Thrips

Species	Host
Thrips palmi	Chili
Megaluruthrips vusitatus	Egg plant
Thrips hawaiiensis	Manggo

Haplothrips ceylonicus	Cocos nucifera

B. INSTITUTION RESPONSIBLE FOR PEST SURVEILLANCE

Department of Agriculture (DOA) is responsible for surveillance of pest in Malaysia with the cooperation of others agencies such as MARDI, Malaysia Palm Oil Board (MPOB), and Malaysia Rubber Board (MRB).

C. REGULAR PEST SURVEILLANCE

DOA has extensive national pest surveillance program on paddy. Others crop pest surveillance were conducted on non schedule basis.

Presently there is no survey program conducted for these 4 groups of insects. DOA doesn't have national surveillance protocols for these specific insect groups.

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Pest	Most Important Species			Most Affected By Species		
	Species 1	**Species 2**	**Species 3**	**Crop 1**	**Crop 2**	**Crop 3**
Leaf miner	Liriomyza spp	Chromatomyia horticola	Phyllocnistis citrella	Cucurbit	Ornamental	Citrus
Whiteflies	Aleurodicus dispersus	Bemisia tabaci	Bemisia argentifolii	Guava	Tomato	Egg plant
Mealy bug	Planococeus citri	Dysmicoccuss brevipes	Pseudococcus longispinus	Citrus	Pineapple	Sweet potato
Thrips	Thrips palmi	Megaluruthrips usitatus	Thrips hawaiiensis	Chili	Egg plant	Manggo

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PEST STATUS REPORT: *Leafminers, Whiteflies, Thrips and Mealybugs in the Phillipines*

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INTRODUCTION

The Leafminers (family*Agromyzidae)* Are prominently seen on mine in the leaves or stems of plants. The bean fly, *Melanogromyza phaseoli* is the most common leafminer in the Phillipines. As of 1999 three invasive species namely; L*iriomyza trifolii* on onions, *Liriomyza huidobrensis* on white potatoes, and *Liriomyza sativae* on tomatoes and egg plants caused considerable economic loss to farmers.

The Whiteflies or Aleyrodids (family *Aleyrodidae)* are very abundant in various agricultual crops green houses. The most common whitefly in the country is *Bemicia tabaci*. This species is polyphagous and infest ornamentals, fruits, vegetables and forest trees. It can transmit the tobacco leaf curl virus.

The Thrips (order *Thysanoptera)* cause serious injury to vegetables, ornamentals, andgrains.*Thrips tabaci* , the onion thrips attack onions , beans, tobacco, and various crops. This pest devastated melons in the 80's in Central Luzon and other melon growing areas of the country. The common thrips in corn on the other hand is *Frankliniella williamson.*

The mealybugs(family *Pseudococcidae)* have *78* known species in the country. A newly recorded mealybug , the buff coco nut mealybug , *Nipaecoccus nipae* (Maskell) has agressively attacked coconuts and other palms during the last four years.

SURVEILLANCE SYSTEM

Pest surveillance is a mandate of the Crop pProtection Division of the Bureau of Plant Industry. On the otherhand the Pest Surveillance and Forecasting Division of the National Crop Protection Center at U. P. Los Banos was put up in 1978 to conduct research, development and extension studies in pest surveillance. Pest surveillance was quite active from the 70's up to the 80's particularly in rice under the BPI administered RP-German Crop Protection Program (GTZ). The BPI continued such function together with the Regional Crop Protection Centers. Now, the Crop Protection Division of the BPI , the Regional Crop Protection Centers and the National Crop Protection Center – U. P. Los Banos which is now a part of the Crop Protection Cluster embarked a cooperative endeavor on corn pest surveillance under the GMA Corn Program in 2004.This is a farmer based corn pest surveillance using mobile phones and we named it PESTEX. The details of this program will be presented. This program envisions to include other pest of major crops. In recognition of the importance of pest surveillance, the government thru the Department of Agriculture alloted a modest amount to the BPI for the said endeavor. U.P. Los Banos will technically backstop the BPI and the Regional Crop Protection Centers together with farmer partners.

CONCLUSION

Surveillance is the first line of defense against pest together with correct diagnosis. Practical and economical surveillance protocols are very invaluable to prevent economic loss due to pest infestation.

Leafminers, Mealybugs, Thrips and Whiteflies of Crops in the Philippines

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
ABACA ***Musa textiles* Nee** **MUSACEAE**					*Javathrips ciliaris*			
AMARYLLIS FAMILY **GARLIC** **(*Allium sativum* L.)** **ONION** **(*Allium cepa* L.)**					*Thrips tabaci*	Onion thrips	*Bemisia tabaci*	
ASPARAGUS **(*Asparagus officinalis L.)***					*Scirtothrips dorsalis*			
BAMBOO ***Bambusa spp.*** **GRAMINAE**			*Chaetococcus bambusae* *Planococcus lilacinus* *Paracoccus interceptus*	Cottony cushion mealybug	*Chirothrips spiniceps* *Dendrothripoides microchaetus* *Elixothrips brevisetis* *Heliothrips haemorrhoidalis* *Phibalothrips peringueyi* *Prepodothrips causiapeltus* *Propesolomonthrips mindorensis* *Stenchaetothrips spinalis*	Greenhouse thrips		
BANANA ***(Musa paradisiaca x sapientum* L.)** **MUSACEAE**			*Dysmicoccus neobrevipes*		*Chaetanophothrips signipennis* *Chirothrips mexicanus* *Dendrothripoides innoxius* *Elixothrips brevisetis* *Helionothrips kodaliphilus*		*Aleurodicus destructor* *Aleurodicus dispersus*	Coconut whitefly Spiraling whitefly

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
					Mecynothrips simplex			
BLACK PEPPER *Piper nigrum* L. PIPERACEAE			*Ferrisia virgata* *Planococcus minor*	Grey mealybug	*Liliothrips chavicae*		*Aleurodicus dispersus* *Dialeurodes sp.*	Spiraling whitefly
CASSAVA (EUPHORBIACEAE *Manihot esculenta* Crantz			*Ferrisia virgata* *Maconellicoccus hirsutus* *Pseudococcus elisae*	Grey mealybug Hibiscus mealybug	*Ayyaria chetophora* *Elaphrothrips denticollis* *Nesothrips lativentris*		*Aleurodicus dispersus* *Bemisia tabaci*	Spiraling whitefly
CASOY OR CASHEW *Anacardium occidentale* L. ANACARDIACEAE					*Frankliniella williamsi* *Scirtothirps dorsalis* *Selenothrips rubrocinetus*	Red-banded thrips		
CASTOR BEAN (EUPHORBIACEAE *Ricinus Communis* L.					*Astrothrips tumiceps* *Ayyaria chaetophora* *Craspedothrips minor* *Gynaikothrips luzonensis* *Rhipiphorothrips pulchellus* *Scirtothrips dorsalis*			
CITRUS **LEMON (DAYAP) – *Citrus aurantifolia* (Christm. & Panz.) Swingle** **ORANGE (NARANJA) – *Citrus reticulata* Blanco** **PUMELO (SUHA) – *Citrus grandis* Osbeck**			*Ferrisia virgata* *Nipaecoccus viridis* *Planococcus citrii* *Planococcus lilacinus* *Planococcus minor* *Pseudococcus citriculus* *Pseudococcus cryptus*	Grey mealybug Citrus mealybug Cottony cushion mealybug Pseudococcus cryptus	*Anaphothrips sudanensis* *Ayyaria chaetophora* *Dolichothrips flavipes* *Elaphrothrips denticollis* *Fulmekiola serrata* *Heliothrips haemorrhoidalis* *Thrips longicaudatus* *Thrips malloti* *Thrips morindae* *Thrips subnudula*	Greenhouse thrips	*Aleurocanthus spiniferus* *Aleurocanthus woglumi* *Aleurocybotus setiferus* *Aleurothrixus floccosus* *Aleurodicus destructor* *Dialeurodes citri*	Citrus blackfly Coconut whitefly

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
KALAMANSI – *Citrus madurensis* Lour.								
CACAO (STERCULIACEAE) *Theobroma cacao* L.			*Ferrisia virgata* *Planococcus lilacinus*	Grey mealybug Cottony cushion mealybug	*Ayyaria chaetophora* *Ecacanthothrips tibialis* *Selenothrips rubrocinctus*	Red-banded thrips		
COCONUT (PALMAE) *Cocos nucifera* L			*Ferrisia virgata* *Palmicultor palmarum* *Sangicoccus sp*	Grey mealybug Palm mealybug Coconut mealybug	*Ethirothriips stenomelas*			
COFFEE (RUBIACEAE) *Coffea spp.*			*Ferrisia virgata* *Nipaecoccus viridis* *Planococcus citri* *Planococcus lilacinus* *Rastrococcus spinosus*	Grey mealybug Citrus mealybug Cottony cushion mealybug	*Propealiothrips moundi* *Selenothrips rubrocinctus* *Thrips hawaiiensis* *Thrips parvispinus*	Red-banded thrips	*Aleurodicus dispersus*	Spiraling whitefly
COTTON *Gossypium spp.* MALVACEAE			*Ferrisia virgata* *Nipaecoccus viridis*	Grey mealybug	*Astrothrips tumiceps* *Ayyaria chaetophora* *Dorcadothrips pulchellus* *Ecacanthothrips tibialis* *Frankliniella schultzei* *Thrips hawaiiensis* *Thrips palmi*		*Aleurocanthus spiniferus* *Aleurodicus dispersus* *Bemisia tabaci*	Spiraling whitefly
GINGER (ZINGIBERACEAE) *Zingiber officinale* Rosc.			*Planococcus japonicus*					
GUAVA			*Ferrisia virgata*	Grey mealybug	*Selenothrips rubrocinctus*	Red-banded thrips	*Aleurodicus dispersus*	Spiraling whitefly

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
(MYRTACEAE) ***Psidium guajava* L.**					*Thrips hawaiiensis*		*Aleurothrixus floccosus* *Aleurotrachelus sp.*	
KAPOK ***Ceiba pentandra* (L.) Gaertn.** **BOMBACAEAE**			*Ferrisia virgata* *Planococcus lilacinus*	Grey mealybug Cottony cushion mealybug			*Aleurocanthus spiniferus* *Aleurodicus dispersus*	Spiraling whitefly
LEGUMES			*Ferrisia virgata* *Planococcus lilacinus*	Grey mealybug Cottony cushion mealybug	*Astothrips tumiceps* *Ayyaria chaetophora* *Chirothrips mexicanus* *Fulmekiola serrata* *Megalothrips typicus* *Megalothrips usitatus* *Microcephalothrips abdominalis* *Phibalothrips peringueyi* *Scirtothrips dorsalis* *Thrips longicaudatus* *Thrips nigropilosus* *Thrips palmi* *Thrips subnudula* *Tusothrips sumatrensis*		*Aleurodicus dispersus* *Bemisia tabaci*	
MALLOW FAMILY **OKRA** **(*Hibiscus esculentus* L.)** **ROSELLE – *Hibiscus sabdariffa* L.**					*Thrips parvispinus*		*Aleurocanthus spinosus* *Aleurodicus dispersus*	Spiraling whitefly
MULBERRY ***Morus alba* L.** **MORACEAE**					*Pseudodendrothrips mori*			

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
NIGHTSHADE FAMILY **EGGPLANT (*Solanum melongena* L.)** **PEPPER (SWEET) (*Capsicum annum* L.)** **PUNGENT (*Capsicum frutescens* L.)** **TOMATO (*Lycopersicon lycopersici* (L.)) Karsten**			*Coccidohystrix insolita* *Ferrisia virgata* *Planococcus minor* *Pseudococcus sp.*	Grey mealybug	*Anaphothrips sudanensis* (on tomato) *Ceratothrips reticulatus* Reyes *Scirtothrips dobroskyi* (on tomato) *Scirtothrips dorsalis* (on pepper) *Selenothrips rubrocinctus* (on tomato) *Thrips hawaiiensis* (on pepper) *Thrips palmi* *Thrips parvispinus* (on pepper) *Thrips sumatrensis* (on eggplant) *Tusothrips sumatrensis* (on tomato)	Thrips Red-banded thrips	*Aleurodicus dispersus* (on eggplant, pepper, potato) *Aleurothrixus floccosus* (on eggplant) *Bemisia tabaci* (on pepper, potato) *Trialeurodes vaporariorum* (on pepper, tomato)	Spiraling whitefly
PAPAYA *(Carica papaya* L.) CARICACEAE			*Dysmicoccus brevipes* *Ferrisia virgata* *Planococcus lilacinus*	Pineapple mealybug Grey mealybug Cottony cushion mealybug	*Exothrips sacchari* *Gigantothrips elegans* *Machatothrips artocarpi* *Thrips hawaiiensis*			
RAMIE *Beohmeria nivea (L.)* URTICACEAE			*Ferrisia virgata*	Grey mealybug				

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
RICE (*Oryza sativa*) POACEAE			*Pseudococcus saccharicola* *Saccharicoccus sacchari* *Trionymus ceres*	Cereal mealybug	*Astothrips globiceps* *Caliothrips striatopterus* *Ecacanthothrips tibialis* *Heliothrips haemorrhoidalis* *Selenothrips rubrocinctus* *Anaphothrips sudanensis* *Ayyaria chaetophora* *Balacothrips graminis* *Chirothrips mexicanus* *Chirothrips spiniceps* *Dendrothripoides innoxius* *Frankliniella intonsa* *Frankliniella schultzei* *Megalurothrips usitatus* *Microcephalothrips abdominalis* *Neohydatothrips sp.* *Stenchaetothrips biformis* *Thrips hawaiiensis* *Thrips sumatrensis*	Greenhouse thrips Red-banded thrips Rice thrips		
RUBBER *Hevea brasiliensis (Willd. x A. Juss.)* M.A. EUPHORBIACEAE			*Ferrisia virgata*	Grey mealybug				

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
SORGHUM (*Sorghum spp.*) POACEAE					*Anaphothrips sudanensis* *Bolacothrips graminis* *Frankliniella williamsi*			
SQUASH FAMILY **AMPALAYA – *Mamordica charantia* L** **CHAYOTE - *Sechium edule* (Jacq.) Swartz** **CONDOL – *Benincasa hispida* (Thunberg) Cogn.** **CUCUMBER – *Cucumis sativus* L.** **MELON – *Cucumis melo* L.** **PATOLA – *Luffa cylindrica* Roem.** **SQUASH – *Cucurbita maxima* Duch.** **UPO –** L***agenaria siceraria* (Molina Standley)** **WATERMELON – *Citrullus lunatus***					*Caliothrips striatopterus* (on squash) *Megalurothrips typicus* (on patola) *Megalurothrips usitatus* *Microcerothrips abdominalis* (patola) *Thrips palmi* *Thrips parvispinus* (on watermelon) *Thrips tabaci*	Onion thrips	*Aleurodicus dispersus* (on ampalaya, cucumber, patola, upo) *Bemisia tabaci* (on squash, upo) *Trialeurodes vaporariorum* (on chayote)	Spiraling whitefly

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
(Thunberg) Mao.								
SUGARCANE (*Saccharum oficinarum* L) POACEAE	*Cosmopteryx dulcivora*	Sugarcane leafminer	*Antonina graminis*		*Anaphothrips sudanensis* *Bolacothrips graminis* *Caliothrips striaptopterus* *Chirothrips spiniceps* *Exothrips sacchari* *Frankliniella williamsi* *Fulmekiola serrata* *Megalurothrips usitatus* *Stenchaetothrips biformis* *Stenchaetothrips minutus* *Thrips morindae* *Thrips tuscus*	Rice thrips	*Aleurodicus dispersus* *Aleurodicus lactea* *Aleurolobus barodensis* *Neomaskellia bergii*	Spiraling whitefly Sugarcance whitefly
SWEET POTATO (*Ipomoea batatas* (L.)	*Bedellia somnulentella* *Chalcomyza ipomoeaphaga*	Sweet potato leafminer Sweet potato leafminer			*Dendrothrips innoxius* *Heliothrips haemorrhoidalis* *Megalurpthrips usitatus* *Microcephalothrips abdominalis* *Thrips hawaiiensis*	Greenhouse thrips	*Aleurodicus dispersus* *Bemisia tabaci*	Spiraling whitefly
TOBACCO *Nicotiana tabacum* L. SOLANACEAE			*Coccidohystrix insolita* *Ferrisia virgata*	Grey mealybug	*Apelaunothrips medioflavus* *Chirothrips mexicanus* *Frankliniella*		*Aleurodicus dispersus* *Bemisia tabaci*	Spiraling whitefly

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
					schultzei *Megalurothrips typicus* *Stenchaetothrips biformis* *Thrips palmi* *Thrips parvispinus* *Tusothrips sumatrensis*	Rice thrips		
WHEAT (*Triticum aestivum* L.) POACEAE					*Bolacothrips graminis*			
WHITE POTATO (SOLANACEAE) *Solanum tuberosum* L.					*Megalurothrips usitatus* *Microcephalothrips abdominalis* *Thrips palmi* Karny			
YAM (DIOSCORIACEAE) *Dioscorea alata* L.			*Planococcus minor*					
AVOCADO *(Persea americana* Mill.) LAURACEAE			*Ferrisia virgata* *Nipaecoccus viridis* *Planococcus lilacinus*	Grey mealybug Cottony cushion mealybug	*Heliothrips haemorrhoidalis* *Thrips subnudula*	Greenhouse thrips		
ANNONAS (*Annona reticulata* L.) **ATIS *(Annona squamosa* L.)** **GUAYABANO (*Annona muricata* L.)**			*Dysmicoccus brevipes* *Ferrisia virgata* *Nipaecoccus viridis* *Planococcus lilacinus*	Pineapple mealybug Grey mealybug Cottony cushion mealybug	*Heliothrips kodaliphilus* *Phibalothrips perengueyi*		*Aleurocanthus spiniferus* *Aleurodicus destructor* *Aleurodicus dispersus* *Aleurothrixus floccossus*	Coconut whitefly Spiraling whitefly
BIGNAY *(Antidema bunius* (L.)					*Gynaikothrips luzonensis*			

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
Spreng.) EUPHORBIACEAE					*Rhipiphorothrips pulchellus*			
DURIAN *(Durio zebethinus* Murr.) BOMBACACEAE			*Dysmicoccus neobrevipes*					
LANZONES *(Lansiun domesticum* Correa) MELIACEAE			*Ferrisia virgata* *Nipaecoccus viridis* *Planococcus lilacinus* *Ferrisia virgata* *Rastrococcus spinosus*	Grey mealybug Cottony cushion mealybug Grey mealybug Tortoise-shell mealybug				
MABOLO *(Diospyros philippensis* (Desr.) Gurke) EBENACEAE					*Dolichothrips pumilus* *Scirtothrips dorsalis* *Selenothrips rubrocinctus*	Red-banded thrips		
MANGOSTEEN *(Garcinia mangostana* L.) GUTTIFERAE			*Dysmicoccus neobrevipes*		*Caliothrips striatoperus* *Heliothrips haemorrhoidalis* *Selenothrips rubrocinctus*			
SANTOL *(Sandoricum koetjapi* (Burm. F.) Merr.) MELIACEAE					*Lefroyothrips fasciatus* *Rhipiphorothrips pulchellus* *Thrips hawaiiensis*			
SINEGUELAS *Spondias pupurea* L. ANACARDIACEAE							*Aleurothrixus floccosus*	

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
TAMARIND *(Tamarindus indicus L.)* LEGUMINOSAE			*Ferrisia virgata* *Nipaecoccus viridis*	Grey mealybug	*Thrips subnudula*			
BREADFRUIT (RIMAS) – *Artocarpus altilis* (Park.) Fos **JACKFRUIT (*Artocarpus heterophyllus* Lam.)** **CAMANSI (*Artocarpus camansi* Blanco)** **MARANG (*Artocarpus odoratissima* Blanco)**			*Ferrisia virgata* *Nipaecoccus viridis* *Planococcus lilacinus*	Grey mealybug Cottony cushion mealybug	*Astrothrips tumiceps* *Ecacanthothrips tibialis* *Haplothrips gowdeyi* *Heliothrips haemorrhoidalis* *Machatothrips artocarpi*	Greenhouse thrips		
CAIMITO OR STAR APPLE *Chrysophyllum cainito* L. SAPOTACEAE			*Ferrisia virgata*	Grey mealybug				
CHICO *Manilkara sapota* (L.) P. van Royen SAPOTACEAE			*Dysmicoccus brevipes* *Ferrisia virgata*	Pineapple mealybug Grey mealybug			*Aleurodicus dispersus* *Aleurothrixus floccosus*	Spiraling whitefly
BALIMBING (*Averhhoa carambola* L.)							*Aleurotrachelus sp. (Balimbing)*	

Crops	Leafminers		Mealybugs		Thrips		Whiteflies	
	Scientific Name	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**
CAMIAS (*Averhhoa bilimbi* L.) OXALIDACEAE								
TIESA OR CANISTEL *Pouteria campechiana* (HBK.) Baehni. SAPOTACEAE			*Ferrisia virgata*	Grey mealybug			*Aleurothrixus floccosus*	
GRAPES *Vitis vinifera* L. VITACEAE			*Ferrisia virgata*	Grey mealybug	*Scirtothrips dorsalis*		*Aleurodicus dispersus* *Bemisia tabaci*	Spiraling whitefly
KENAF – *Hibicus cannabinus* L. ROSELLE – *Hibiscus sabdariffa* L. MALVACEAE			*Ferrisia virgata* *Maconellicoccus hirsutus* *Nipaecoccus viridis* *Planococcus lilacinus*	Grey mealybug Hibiscus mealybug Cottony cushion mealybug			*Aleurocanthus spinosus*	

APEC Planning Workshop on
Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access
May 22-25, 2006
Kuala Lumpur, Malaysia

Singapore Country Report for Planning Workshop on Capacity Building in Surveillance and Diagnosis for Leafminer, Thrips, Whitefly and Mealybug Pests in Developing APEC Economies

A. SPECIES NAMES & KNOWN HOSTS

Leafminers found in Singapore

Species	Host
Liriomyza sp.	*Brassica chinensis var parachinensis (*Chyse Sim / Baicai*)* *Brassica chinensis var chinensis (*Pak Choy / Chinese Cabbage*)* *Brassica oleracea var capitata (*Cabbage*)*
Neolithocolletis pentadesma	*Pterocarpus indicus* (Angsana)
Phyllocnistis citrella	*Citrus spp.*

Mealybugs found in Singapore

Species	Host
Rastrococcus spinosus	*Lycopersicon esculentum* (Tomato)
Crisicoccus chalepus	*Hibiscus tilliaceus*
Dysmicoccus nesophilus	*Hibiscus tilliaceus* *Lumnizera littorea (*Teruntum Merah*)*
Crypicera jacobsoni	*Avicennia alba (*Api-Api Putih*)*
Planococcus lilacinus	*Saintpaulia ionantha* (African Violet)
Pseudaulacaspis pentagona	*Juniperus chinensis* (Chinese Juniper)
Pseudococcus longispinus	*Ipomea batatas* (Sweet Potato Leaf / Keledek)

Thrips found in Singapore

Species	Host
Dichromothrips corbetti *Thrips palmi* *Selenthrips rubrocinctus* *Liothrips sp.* *Thrips hawaiiensis* *Heliothrips sp.*	*Arachnis sp.* *Dendrobium sp.* *Vanda sp.* *Oncidium sp.*
Liothrips sp.	*Fagraea fragrans* (Tembusu) *Ficus benjamina* (Waringin) *Meleleuca quiquenervia*

Whiteflies found in Singapore

Species	Host
Bemisia tabaci	*Cucurmis sativum* (Cucumber) *Lycopersicon esculentum* (Tomato) *Solanum melongena* (Aubergine) *Hibiscus tilliaceus*
Aleurocanthus sp.	*Psidium guajava* (Guava) *Michelia chempaka* *Mussaenda erythrophylla* *Mussaenda philippica*
Aleurocanthus spiniferus	*Citrus sp.*
Aleurodicus destructir	*Psidium guajava* (Guava) *Cochlospermum religiosum* (Buttercup tree)
Aleurodicus sp.	*Manihot esculenta* (Tapioca) *Psidium guajava (Guava)* *Abies balsamea* (Balsam Fir) *Aegicerus corniculatum* (Kacang-kacang) *Plumeria rubra* (Frangipani) *Acalypha hispida* *Cochlospermum religiosum* (Buttercup tree) *Rhizophora apiculata* (Bakau Minyak)
Aleurotuberculatus sp.	*Hibiscus tilliaceus*
Bemisia sp.	*Hibiscus rosa-sinensis*
Saisettia miranda	*Hibiscus tilliaceus*
Tetraleurodes sp.	*Hibiscus tilliaceus*

B. INSTITUTION RESPONSIBLE FOR PEST SURVEILLANCE

The Agri-Food and Veterinary Authority (AVA) is responsible for pest surveillance in Singapore.

C. REGULAR PEST SURVEILLANCE IN SINGAPORE

AVA runs pest surveillance programs for both endemic and exotic pests.

Endemic pests surveyed are:

- *Plutella xylostella,* Diamondback moth
- *Brontispa longissima,* Palm Hispid Beetle
- Thrips (assorted species)

Exotic pests surveyed are:

- *Trogoderma granarium,* Khapra Beetle
- *Bactrocera tryoni,* Queensland Fruitfly
- *Ceratitis capitata,* Meditteranean Fruitfly
- *Bursaphelenchus xylophilus*, Red ring nematode

D. THRIPS SURVEILLANCE IN SINGAPORE

This is carried out weekly. 5 farms have been identified to be sampled. These farms are chosen to cover the spread of the orchid growing areas in Singapore. Each farm is about 3-5 ha. In each farm, 3 blue sticky traps are placed as widely spaced apart as feasible. Each week, the sticky traps are collected for counting of thrip numbers, but the thrip species are not identified. Farmers are informed if there are any notable increases in the average numbers of thrips detected (average increase more than 10) and counter-measures are proposed.

Currently, there are no ascertaind threshold nos. for the pests to determine outbreaks. However, contingency plans in the event of outbreak are available for whiteflies and thrips. There is no formal guideline available to determine the locations, sample size for surveillance

For other pests, only general surveillance, and not pest-targetted surveillance, is carried out.

APEC Planning Workshop on Surveillance

Kuala Lumpur, Malaysia
22-25 May 2006

	Please give most important species			**What crops most affected by species**		
	Species 1	**Species 2**	**Species 3**	**Crop 1**	**Crop 2**	**Crop 3**
Leaf miner	*Liriomyza sp.*	*Neolithocolletis pentadesma*	*Phyllocnistis citrella*	*Brassica chinensis* varieties	*Citrus sp.*	*Pterocarpus indicaus* (roadside tree)
Whiteflies	**Bemisia tabaci**	*Aleurocanthus spiniferus*	*Aleurodicus destructir*	*Cucurmis sativum*	*Lycopersicon esculentum*	*Solanum melongena*
Mealy bug	*Rastrococcus spinosus*	*Pseudococcus longispinus*	*Dysmicoccus nesophilus*	*Lycopersicon esculentum*	**Ipomea batatas**	*Hibiscus tillaceus*
Thrips	**Thrips palmi**	*Liothrips sp.*	*Dichromothrips corbetti*	*Dendrobium sp.*	*Vanda sp.*	*Oncidium sp.*

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ECONOMY REPORT : THAILAND

The Status of Leafminers, Whiteflies, Thrips and Mealybugs in Thailand

APEC Planning Workshop on Capacity Building in Surveillance and Diagnosis of Leafminer, Whitefly, Thrips, Mealybug Pests

May 22-25, 2006

Corus Hotel, Kuala Lumpur

Malaysia

The Status of Leafminers, Whiteflies, Thrips and Mealybugs in Thailand

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The current trend in world trade is to open markets in what are commonly called free trade areas. Thailand has become a member of the World Trade Organization (WTO) and is committed to abide by the SPS Agreement. It has become increasingly apparent that trade is constrained by deficiencies in plant health.

Thailand is both an exporting and importing country of fresh agricultural produce. There are many types of vegetables and fruits grown in all regions of Thailand. Insect pests are one of the main problems in production and importing countries must assess the risk this. Leafminers, whiteflies, thrips and mealybugs are small insects that are significant for fresh agricultural produce especially vegetables and fruits for export. Their status in Thailand is described below:

Leafminer

There are 2 orders of leafminer found in economic vegetables and fruit. Leafminer flies are always found in vegetables such as cruciferous, potato, yard long bean , tomato, okra, shallot and onion. The important family is Agromizidae. It mines in old foliage and eats the green cells of the plant. In the case of exported vegetables, *Liriomyza* is an important pest and has a chance to contaminate therefore this genus is a regulated pest. *Liriomyza brassicae* is found on cruciferous and potato. On tomato and yard long bean, the same genera is found in but unidentified species. In shallot and onion, *L. chinensis* . *Agromysa* sp. is found only in okra. In fruit trees, we find leafminer, order Lepidoptera, in citrus and mangosteen. The citrus leafminer, *Phyllocnistis citrella* is found to damage young leaves, young branches and fruit in tangerine, pomelo and lime. Its very common and widespread in the production areas of Thailand. In mangosteen, we found *Phyllocnistis* sp. in young foliage and severe infestation occurs in young leaves, especially at the seeding stage, causing stunting. Mature mangosteen, if severely attacked, have frequent leaf production to compensate for leaf damage.

Whitefly

The tobacco whitefly, *Bemesia tabaci* has been reported to damage okra, tomato, chili and eggplant in Thailand. It causes damage by sucking the cell sap in leaves and transmitting virus diseases especially geminivirus. In tomato, whitefly transmits tomato yellow leaf curl virus (TYLCV); tomato leaf curl disease can decrease production also by 10-100%. Okra is an economically important vegetable exported to Japan. Tobacco whitefly is serious insect pest, transmiting geminivirus, resulting in yellow vein disease and yellow fruit that the market will not accept. In chili and eggplant, the whitefly attacked by sucking the cell sap, but disease transmission has not been reported.

Thrips

Thrips are an important insect pest of fruit trees and vegetables in Thailand. Apart from causing production losses, thrips are an important problem in fruit and vegetable exports, like leafminers and whiteflies. It has been reported that *Thrips palmi* and *T. tabaci* attack vegetables such as eggplant, melon, cucumber, asparagus, chili, potato shallot, onion. *Megalurithrips usitatus* damages yard long bean and garden pea. An important thrips species damageing vegetables and fruit trees is chili thrips, *Scirtothrips dorsalis*, found to damage young parts of various vegetables such as chili, pototo where it is found to stunt shoots. Chili thrips infest a variety of fruits such as pomelo, tangerine, mango, mangosteen and grape. Both nymphs and adults suck plant juices from various plant parts. The damaged young leaves and terminals appear stunted, distorted and burnt. Infestation during the flowering and young fruit stages causes dropped flowers and fruits. When attacked, the skin texture of the remaining fruit becomes coarse resulting in low prices. Furthermore, There are many species of thrips found from various parts of fruit trees. For example there are 8 species of thrips associated with pomelo. *Haplothrips* sp. and S. *digochartus* damage leaves and flowers, *Scirtothrips dorsalis* damage young leaves, shoots, flowers and young fruits and 5 species, *Megalurothrips usitatus*, *Frankliniella* sp., *Thrips coloratus*, *T. hawaiiensis* and *T. parvispinus* damage flowers.

Mealybugs

Mealybugs have become an increasingly important factor in fruit exports since they stick to the fruits and exporters new high cleaning costs before exporting. Mealybugs which completely destroy fruit trees are in the Family Pseudococcidae. Both nymphs and adults feed by sucking sap from leaves and fruit. They excrete honeydew on which black sooty mold thrives, reducing the sunlight reaching leaves, thus reducing photosynthesis. In the most the fruit is also dirty and low quality fruit and this reduces market value. Mealybugs feed on a wide range of plants, so one kind of mealybugs is found on many kinds of plants and one kind of plants can host many kinds of mealybugs. There are 2 species of mealybug found on both pomelo and tangerine : *Ferrisia virgata* and *Nipaecoccus viridis* and *Rastrococcus invadens* only found on pomelo. It has been reported that *Dysmicoccus neobrevipes, Planococcus miner* and *Pseudococcus cryptus* attack mangosteen. In durian, we find *Planococcus miner*, *P. lilacinus* and *Pseudococcus cryptus*. 4 genera and 5 species attack various parts of the mango tree. *D. neobrevipes*, *F. virgata*, *R. spinosus*, *R. iceryoides* and *P. cryptus* are found in vegetables where they are not an important pest but recently *Planococcus solani* has been found to damage okra.

Table 1 List of Leafminer, whitefly, thrips and mealybug reported in vegetables and fruits in Thailand

Pest	Scientific name	Family	Order	vegetable/fruit
Leafminer	*Liriomyza brassicae* Riley	Agromizidae	Diptera	cruciferous, potato
	Liriomyza chinensis Koto	Agromizidae	Diptera	shallot, onion
	Liriomyza sp.	Agromizidae	Diptera	tomato, yard long bean
	Agromysa sp.	Agromizidae	Diptera	okra
	Phyllocnistis citrella Stainton	Phyllocnistidae	Lepidoptera	tangerine, pomelo, lime
	Phyllocnistis sp.	Phyllocnistidae	Lepidoptera	mangosteen
Whitefly	*Bemesia tabaci* (Gennadius)	Aleyrodidae	Homoptera	tomato, okra,eggplant, chilli
Thrips	*Thrips palmi* Karny	Thripidae	Thysanoptera	eggplant, melon, cucumber, asparagus, chili, potato
	Megalurithrips usitatus (Bagnall)	Thripidae	Thysanoptera	yard long bean, garden pea
	Scirtothrips dorsalis Hood	Thripidae	Thysanoptera	chili, potato, pomelo, tangerine, mango, mangosteen, grape
	Scirtothrips oligochaetus Karny	Thripidae	Thysanoptera	mangosteen, mango
	Thrips parvispinus Karny	Thripidae	Thysanoptera	chili, pomelo
	Thrips tabaci Lindeman	Thripidae	Thysanoptera	shallot, onion, asparagus

Pest	Scientific name	Family	Order	vegetable/fruit
	Garatothripoides sp.	Thripidae	Thysanoptera	potato
	Thrips coloratus Schmutz	Thripidae	Thysanoptera	mango, pomelo
	Thrips haweiiensis Morgan	Thripidae	Thysanoptera	mango, pomelo
	Haplothrips sp.	Thripidae	Thysanoptera	mango, pomelo
	Megalurothrips typicus Bagnall	Thripidae	Thysanoptera	mango
	Emothrips lobatus Bhatti	Thripidae	Thysanoptera	mango
	Selenothrips rubuocinetus Giard	Thripidae	Thysanoptera	mango
	Frankliniella sp.	Thripidae	Thysanoptera	pomelo
Mealybug	*Ferrisia virgata* (Cockerell)	Pseudococcidae	Homoptera	pomelo, tangerine, jack fruit, guava, mango, sugarapple, rambutan
	Nipaecoccus viridis (Newstead)	Pseudococcidae	Homoptera	pomelo, tangerine, lime, jack fruit
	Restrococcus invadens Willium	Pseudococcidae	Homoptera	mango, pomelo, tangerine
	Dysmicoccus neobrevipes Beardsley	Pseudococcidae	Homoptera	mangosteen, mango, sugarapple, jack fruit, guava, banana,

Pest	Scientific name	Family	Order	vegetable/fruit
	Planococcus miner (Maskell)	Pseudococcidae	Homoptera	durian, banana, rambutan, sugarapple
	Pseudococcus cryptus Hempel	Pseudococcidae	Homoptera	durian, mangosteen, mango
	Cataenococcus hispidus (Morrison)	Pseudococcidae	Homoptera	Lon gong
	Planococcus lilacinus (Cockerell)	Pseudococcidae	Homoptera	rambutan, durian, sugarapple
	Rastrococcus spinosus (Robinson)	Pseudococcidae	Homoptera	mango, cashew nut
	Rastrococcus iceryoides Green	Pseudococcidae	Homoptera	mango
	Rastrococcus invadens Williums	Pseudococcidae	Homoptera	lon gong
	Planococcus solani	Pseudococcidae	Homoptera	okra

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LEAFMINERS, WHITEFLIES, THRIPS AND MEALYBUGS ON AGRICULTURAL CROPS IN VIET NAM

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Agricultural crop production in Viet Nam

In Viet Nam, agricultural sector plays an important role in economy, it accounts for 23,6% of GDP and employs the largest proportion of the national labour force (71%). Agricultural crop products of Viet Nam are paddy rice, corn, sorghum, cassava, potatoes, sweet potatoes, rubber, beans, soybeans, coffee, tea, fruits, vegetables, sugarcane... Most of these crop products are exported to many countries in the wolrd. Recently, agricultural crop production of Viet Nam has been changing in its structure, from unproductive and unstable rice production to more profitable production of cash crops, industrial crops and fruits... and has recorded some considerable achievements. Table 1 presents status of production of major crops in Viet Nam.

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Table 1. Major agricultural crops in Viet Nam
(Sourse: MARD 2002)

No	Crop	Area (thousand ha)	Productivity (thousand tones)
1	Rice	7484	32000
2	Maize	909	889
3	Coffee	567	844
4	Peper	35	44.4
5	Rubber	418	300.7
6	Tea	100	100
7	Cashew nuts	199	140
8	Fruits	570	4500
9	Vegetables	500	6600
10	Sugarcane	291	14300

Pest status of leafminers, whiteflies, thrips and mealybugs on agricultural crops in Viet Nam.

The species composition of leafminers, whiteflies, thrips and mealybugs on agricultural crops in Viet Nam was detected and recorded through many surveys which were conducted at different time and scope. Therefore, the literature dealing with the species composition of these pests is scattered in many publications, most of them are out of date or very limited in

scope and many related information are not available. However, the number of species of the 4 above mentioned pest groups has been detected and recorded is increasing in recently years by different reseach programs. This increase indicates the importance of these pests and the concern of research community on them. The list of species compostion of the 4 groups, their pest status rating, their host crops, distribution, and year recorded is presented in Table 2.

Table 2. Species composition of leafminers, whiteflies, thrips and mealybugs on agricultural crops in Viet Nam.

No	Scientific name	Rating	Host crops	Distribution	Year recorded
	Homoptera:				
	Aleyrodidae				
1	*Aleurodicus dispersus* Rusell	+	Soursop	Southern of VN	2001 - 2003
2	*Aleurocanthus spiniferus* (Quaintance)	+ +	Citrus	Nation-wide	1968
3	*Aleurocanthus woglumi* Ashby	+	Citrus (Nation-wide)	Nation-wide	1997 - 1998
4	*Aleurocanthus* sp.	+	Longan, litchi, grape, guava	Nation-wide	1997 - 1998
5	*Aleurocybotus indicus* David & Subramaniam	+ +	Rice	Southern of VN	1978
6	*Bemissia myricae* Kuwayana	+ +	Polyphagous (soybean, cotton, beans, cucumbers, groundnut, tobacco, tomato) (Nation-wide)	Nation-wide	1967
7	*Bemisia* sp.	+	Soybean, mulberry, tomato, crucifers	Nation-wide	1967
8	*Bemisia tabaci* (Gennadius)	+	Tobacco	Sothern of VN	1978
9	*Dialeurodes citri* Kuwayana	+	Custard-apple	Southern of VN	1997 - 1998
	Psedococcidae				
10	*Dysmicoccus brevipes* Koch	+ + +	Pineapple	Nation-wide	1977
11	*Dysmicoccus neobrevipes* Beardsley	+	Pineapple	Nation-wide	1985
12	*Dysmicoccus* sp.	+ +	Polyphagous (16 cultivated plants)	Nation-wide	1999 - 2004
13	*Ferrisia virgata* Cockerell	+ +	Polyphagous (15 cultivated plants)	Nation-wide	1985
14	*Maconellicoccus hirsutus* Green	+	Hibiscus	Southern of VN	1999 - 2004
15	*Nipaecoccus nipae* Maskell	+ +	Citrus, Coconut	Nation-wide	1969, 1985
16	*Nipaecoccus* sp.	+	Citrus, breadfruit, tamarine	Nation-wide	1999 -2004
17	*Nipaecoccus vastator* (Masic)	+	Citrus	Northern of VN	1968
18	*Phenacoccus* sp.	+	Citrus	Northern of VN	1968
19	*Planococcus lillacinus* Cockerell	+	Cacao, soursop, rambutan, rose-apple	Southern of VN	1999 - 2004
20	*Planococcus citri* Risso	+ + +	Polyphagous (Citrus, litchi, longan, rambutan, peper, potato…)	Nation-wide	1968
21	*Pseudococcus citriculus* Green	+	Citrus, soursop, coffee,	Southern of VN	1990
22	*Pseudococcus comstocki* Kuwayana	+	Citrus, bananas	Nation-wide	1968
23	*Pseudococcus candyensis Comstock*	+	Citrus	Northern of VN	1985 - 1986
24	*Pseudococcus longispinus*	+	Coffee, cacao, citrus	Nation-wide	1999 -2004, 2005
25	*Pseudococcus* sp.	+ +	Cotton, custard-apple, guava, mango, rambutan, durian, sapodilla	Nation-wide	1977
26	Rastrococcus spinocus Robinson	+	Soursop	South of VN	2001 - 2003
27	Rastrococcus truncatispinus William	+	Citrus	Northern of VN	2005
28	Rastrococcus sp.	+ +	Plolyphagous (12 cultivated plants: Sapodilla, mango, coffee, bananas…)	Nation-wide	1997 - 1998
29	*Rastrococcus* sp1	+	Citrus	Northern of VN	1990

30	*Rastrococcus* sp2	+	Citrus	Northern of VN	1990
31	*Saccharicoccus sacchari* Cockerell	+	Sugarcane	Nation-wide	1967
	Thysanoptera				
	Phloeothripidae				
32	*Phoeothrips* sp.	+	Rice, corn	Northern of VN	1967
33	*Phoeothrips oryzae* Matsumura)	+	Rice, corn	Southern of VN	1977
34	*Pseudodenddrothrips mori* Niwa	+	Mulberry	Northern of VN	1967
35	*Haplothrips aculeatus* Fabricius	+	Rice, groundnut		1977
	Thripidae				
36	*Anaphothrips theivorus* Karny	+ +	Tea	Southern of VN	1969
37	*Calliothrips indicus* (Bagnall)	+	Groundnut	Southern of VN	1978
38	*Frankliniella intosa* Trybon	+	Citrus	Northern of VN	2005
39	*Frankliniella* sp.	+	Citrus, rice, corn, cotton, groundnut,	Nation-wide	1977
40	*Heliothrips haemorroidalis* Bouch	+ +	Bananas		1997
41	*Megalurothrips usitatus* Bagnall	+	Groundnut		1991 - 1995
42	*Physothrips setiventris*	+	Tea	Northern of VN	2005
43	*Saccharothrips serratus* Kobus	+	Sugarcane		1977
44	*Scirthrips dorsalis* Hood	+	Groundnut, tea, citrus, mango	Nation-wide	1978
45	*Stenochaetothrips biformis* (Bagnall)	+	Rice	Nation-wide	1978
46	*Thrips imaginis*	+	Citrus	Northern of VN	2000
47	*Thrips palmi* Karmy	+	Potato, cucurbits, beans, tomato	Hanoi	2004 - 2005
48	*Thrips tabaci* Lindeman	+ +	Cotton, tomato, tobaco, onion	Nation-wide	1978
49	*Thrips* sp.		Plum, grape, pineapple, beans, mango	Nation-wide	1997, 2005
50	**Lepidoptera**				
51	**Phyllocnistidae (Gracilariidae)**				
50	*Acrocercops* sp. (*A. cramerella* Snellen)	+	Longan, litchi	Nation-wide	1997 - 1998
51	*Conopomorpha litchiella* Bradley	+	Longan, litchi	Nation-wide	1997 - 1998
52	*Conopomorpha sinensis* Bradley	+	Longan, litchi	Nation-wide	1997 - 1998
53	*Lithocollestic* sp.	+	Plum, peach	Northern of VN	1997 - 1998
54	*Phyllocnistic citrella* Staiton	+ + +	Citrus	Nation-wide	1967, 1977
	Diptera				
	Agromyzidae				
55	*Japanagromyza tristella* Thomson	+ +	Soybean	Nation-wide	1977
56	*Melanagromyza sojae* Zehntner	+ + +	Soybean, beans (Stem borer fly)	Nation-wide	1977
57	*Liriomyza sativae* Blanch	+ + +	Vegetables, flowers and ornamental plants	Nation-wide	1999
58	*Ophiomyia* sp.	+ +	Beans (Stem borer fly), groundnut	Northern of VN	1967
59	*Ophiomyza atricornis* Meigon	+ +	Beans	Northern of VN	2004 - 2005
60	*Phytomyza atricornis* Meigen	+ +	Beans, cabbage	Northern of VN	1967

Note: + + + very widspread and very important
+ + widespread and important
+ important locally

According to the known records of our investigations there are 9 species of whiteflies (Homoptera: Aleyrodidae), 22 species of mealybugs (Homoptera: Pseudococcidae), 18 species of Thrips (Thysanoptera: Phloeothripidae: 4 and Thripidae: 14), 11 species of leafminers (Lepidoptera: Gracilariidae: 5; Diptera: Agromyzidae: 6). Many of them are polyphagous, widespread and serious pests on servaral agricultural crops in many provinces of Viet Nam. For example, *Planococcus citri* Risso a polyphagous pest, only on coffee it damaged 1,400 ha coffee in Gia Rai (1993), 452,3 ha in Dak Lac caused nearly 100% yeild lost (2002), and about 300 – 500 ha in Son La caused to 60% of yield lost.

Pest suveillance system in Viet Nam

Recognising the importance and the value of insect pest management in agriculture, attention has been given to insect pest surveillance and a number of major surveillances were conducted in Viet Nam since 1967. In our country, the National Institute for Plant Protection (NIPP) and the Plant Protection Department (PPD) (Ministry of Agriculture and Rural Development - MARD) are main institutions which are mandated for pest surveillance. All the national major surveys conducted in Viet Nam have been carried out by NIPP (see Table 3). Aside NIPP and PPD, a number of institutetions in Viet Nam also is involved in pest surveylance such as: Institute of Ecology and Natural Resources (IENRI, Southern of Fruit Research Institute (SOFRI), Ha Noi Agricultural University (HAU)… NIPP has the biggest agricultural pest collections.

Table 3. Surveys conducted and the number of pest species recorded.

Year of survey	Number of species recorded					
	Homoptera		Thysanoptera		Lepidoptera	Diptera
	Aleyrodidae	Pseudococcidae	Phloeothripidae	Thripidae	Gracilariidae	Agromyzidae
1. 1967 - 1968	3	5	1	0	1	2
2. 1977 - 1978	4	10	2	7	1	2
3. 1984 - 1985		8				
4. 1997 - 1998	4	6	-	4	5	-
5. 1999 - 2004	-	13	-	-	-	-
6. 2004 - 2005	1	-	-	2	-	2

Note: 1. Conducted in the northern of Viet Nam only on all agricultural crops and wild plants
2. Conducted in the southern of Viet Nam only on all agricultural crops and wild plants
3. Conducted in the northern of Viet Nam on citrus only
4. Conducted in the whole country but on fruit crops only (23 fruit crops)
5. Conducted in the southern of Viet Nam on cultivated plants (23 fruit crops, 8 industrial plants, 1 food plant and 13 ornamental plants)
6. Conducted in the northern of Viet Nam on 27 vegetable crops

Pest surveillance program in Viet Nam

NIPP and PPD are planning a general national pest surveillance program on agricutural crops and wild plants. It will be carried out from 2006 to 2008 in the whole country.

Regular pest surveillance program is conducted by NIPP and PPD on major crops for pest forecast and control. Although there is no specific program for the leafminers, whiteflies, thrips and mealybugs on agricultural crops in Viet Nam, these pests are detected, monitored in different research programs on different crops. Fore example, NIPP is conducting the survey of Pseudococcidae on peper and coffee in Southern of Viet Nam.

The needs of pest surveillance in Viet Nam

Viet Nam agricultural sector is on the way to integrate itself into the regional and global economy. Our task is to ensure that sanitary and phyto-sanitary measures are applied and met the international and regional standards, and to facilitate procedures on animal and plant quarantine. Like in many other contries in the wolrd, insect pests in Viet Nam are a major constraint to agricultural crop production. To protect agricultural crop production and to achieve sustainable agricultural development, the plant protectionists and farmers must develop and carry out integrated and environmentally sound pest management strategies.

Surveillance, diagnostic and indentification of the pest are the first steps for successful pest management strategies.

In Viet Nam, for many insect pests in general and for the 4 above mentioned pest groups, the information on their distribution, on their host range as well as on the estimated economic losses caused by a specific pest is not availabe or very limited. In addition, Viet Nam is also lacking of in-country experts on pest diagnostic and identification. We need to strengthen our capacity in this sector to ensure that both plant protection and plant quarantine precautions in Viet Nam being carried out effectively and efficiently. The project will help us to develop the protocol and standard methods for surveillance, speciment collection and idetification of leafminers, whiteflies, thrips and mealybugs.

APEC Planning Workshop on Surveillance

Kuala Lumpur, Malaysia
22-25 May 2006

	Please give most important species			What crops most affected by species		
	Species 1	**Species 2**	**Species 3**	**Crop 1**	**Crop 2**	**Crop 3**
Leaf miner	*Liriomyza sativae* Blanch	*Melanagromyza sojae* Zehntner	*Phytomyza atricornis* Meigen	Vegetables	Beans	Beans
Whiteflies	*Aleurocanthus spiniferus* (Quaintance)	*Bemissia myricae* Kuwayana	*Bemisia* sp.	Citrus	Soybean	Crucifers
Mealy bug	*Planococcus citri* Risso	*Dysmicoccus* sp.	*Ferrisia virgata* Cockerell	Citrus	Pineapple	Mango
Thrips	*Scirthrips dorsalis* Hood	*Thrips palmi* Karny	*Thrips tabaci* Lindeman	Groundnut	Cucurbits	Tomato

APEC Mentoring Report: Brunei Darussalam

1. Project Title	**Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access**
2. Project Code	ATC 01/2006A
3. Persons conducting mentoring	Dr. Soetikno S. Sastroutomo and Dr. Lim Guan Soon
4. Mentoring dates	5-8 March 2007 (arrival date 4th and departure date 9th)
5. Location/Institutions	Brunei Agriculture Research Centre, Bandar Seri Begawan
6. People visited/concerned	1. Mr. Jomari Hj. Ahmad 2. Mr. Hj. Sofian Muhammad Zaim
7. Purpose	To evaluate progress of the survey workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	Mr. Hj. Sofian Muhammad Zaim attended the survey training workshop held in Malaysia during May 2006. The mentoring team had discussions with him and also Mr. Jomari Hj. Ahmad to evaluate the progress of the survey being undertaken, including visit to the laboratories and the fields. They explained that in general the survey activities for leafminers and thrips from vegetable fields have been progressing well and no serious problem was encountered. To date, these two insect groups have been surveyed and collected from different locations in Muara and Tutong Districts. All specimens have been mounted and are ready for identification. Unfortunately, due to budget constraints they could not participate in the APEC Reentry Workshop on Thrips and Leafminer Flies that was held very recently. Pest surveillance (including white flies and mealybugs) on citrus in Muara District, especially in Junjungan has been done through internal project activities funded by the Government. In relation to this, the mentoring team visited the citrus orchards in this area. For mealybugs, many specimens have also been collected from different crops and wild plants. More surveys would be done in early April

	before the up-coming diagnostic workshops on whiteflies and mealybugs (16-26 April 2007). Assurance was also given to the mentoring team that all groups of the specimens will be brought to the diagnostic workshops for identification, reconfirmation and other related studies. Mr. Hj. Sufian has been proposed to participate in the APEC Reentry Workshop to be held in Malaysia in April.
• **Facilities and collected specimens**	The mentoring team visited the laboratories-cum-office where collections of leafminers, white flies, mealybugs and thrips are being kept. In general, the laboratory facilities of Plant Pest Unit of BARC are well-equipped with good insect collections for training purposes, particularly those of thrips and leafminers. There are also available several insect screen houses where insect culturing and research work can, and are being undertaken.
• **Constraints**	Brunei did not experience any constraint to do surveillance as they have additional funds provided by the government to support the field surveys and collections of specimens. More comprehensive collection of thrips, leafminers, whiteflies and mealybugs from a wide range of different crops in different districts of the country would be done using the allocated fund of 2007.
• **Remarks and suggestions**	1. Explanation was made to Mr. Jomari Hj. Ahmad and Mr. Hj. Sofian Muhammad Zaim on the objectives of the current APEC project mentoring visit and the purpose of the upcoming APEC Reentry Workshop on Whiteflies and Mealybugs. It was made known to them that the diagnostic workshop for whiteflies and mealybugs would be organised from 16-26 April 2007. 2. For the APEC Reentry Workshop on Whiteflies and Mealybugs, Mr. Hj. Sufian indicated that he would participate in the workshops, pending approval from his government. He would bring along all the needed specimens for the diagnostic activities. 3. It was agreed that the APEC project fund allocated to support the surveys and specimen collections will be

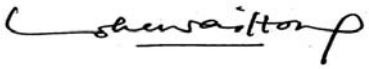
	provided to Mr. Hj. Sufian, pending his submission of claims to CABI.

Signature: ……	……
Name: Dr. Soetikno S. Sastroutomo	Dr. Lim Guan Soon
Date:……	……

APEC Mentoring Report: China

1. Project Title	Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Member Economies for Improved Market Access
2. Project Number	ATC 01/2006A
3. Persons conducting mentoring	Dr. Loke Wai Hong and Dr. Lim Guan Soon
4. Mentoring dates	19 – 21 September 2006. (Arrived Beijing 18 September; departed Beijing 22 September).
5. Location/Institutions	Centre for Management of Invasive Alien Species (CMIAS), MoA, Beijing, China
6. People visited	Dr. Wan Fanghao
7. Purpose	To evaluate the progress of the project inception workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	Both Dr. Wan Fanghao from CMIAS and Dr. Ren of Guangzhou Agricultural University attended the project inception workshop held in Malaysia during May 2006. The mentoring team could only meet with Dr. Wan since Dr. Ren was unable to travel to Beijing because of prior commitments during the period of the team's visit. This, however, did not pose any problem since both Dr. Wan and Dr. Ren have been in regular communications and have been interacting closely on the project activities. Dr. Wan explained that in general the survey activities have been progressing well and there were no serious problems. To date, specimens for all the four sucking insect groups (thrips, leafminers, whitefliles and mealybugs) have been surveyed and collected from both leafy and fruit vegetables in Guangzhou. In Beijing, many specimens of thrips have also been collected and the others will be surveyed before the up-coming diagnostic workshops. All groups of the specimens will be brought to the diagnostic workshops for identification and other related studies.
• **Facilities and collected specimens**	The mentoring team also visited the office of Dr. Wan where some insect cultures are being maintained and noted to be doing well. The laboratory facilities of CAAS-CMIAS are well-equipped and there are numerous insect screen houses available where insect culturing and research work are undertaken. It is clear that the physical facilities and capability of the staff of CMIAS are in an unquestionable position to carry out the surveys and specimen collections. Although we did have the opportunity to visit the facilities and inspect the specimens collected by Dr. Ren in Guangzhou, we were assured by Dr. Wan that the conditions in Guangzhou Agricultural University are likewise well supported for carrying out the survey and specimen collection satisfactorily.

• **Constraints**	China, unlike the case in Thailand, did not experience any constraint due to the limited fund allocation provided by the project to support the field surveys and collection of specimens. This is because they have other survey-related projects where the funding can partially help the APEC project surveys and specimen collection. Thus, both Dr. Wan and Dr. Ren are able to undertake a more comprehensive collection of thrips, leafminers, whiteflies and mealybugs from a wide range of different crops in the country.
• **Remarks and suggestions**	1. Explanation was made to Dr. Wan on the objectives of the current APEC project mentoring visit and the purpose of the upcoming follow-up 5-day diagnostic training workshops. It was made known to him that tentatively the diagnostic workshops are planned for February 2007 (for thrips and leafminers) and April 2007 (for whiteflies and mealybugs) and participants are expected to bring along national specimens for identification and other diagnostic work in the workshops. 2. For the up-coming workshops, Dr. Wan indicated that he could possibly only participate in one of the workshops, i.e. in April. For the February workshop, he is scheduled to be in USA on another project on Invasive Alien Species. However, he would ensure that a qualified and suitable alternative will participate and this representative would bring along all the needed specimens for the diagnostic activities. 3. Several sessions of discussions were held with Dr. Wan on how further survey for more specimens are to be carried out, including how they should be properly stored to ensure the specimens do not deteriorate prior to the up-coming diagnostic workshops. Since Dr. Ren was not present, assurance was obtained from Dr. Wan that he would convey all the requirements in detail to Dr. Ren so that all the needed tasks will be undertaken properly. 4. It was agreed that the APEC project fund allocated to support the survey and specimen collection in China will be provided to Dr. Wan to coordinate and manage. He will disburse whatever is required by Dr. Ren accordingly.



Signature:
Name: Dr Loke Wai Hong
Date: 12 October 2006

APEC Mentoring Report: Chinese Taipei

1. Project Title	**Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access**
2. Project Code	ATC 01/2006A
3. Persons conducting mentoring	Dr. Loke Wai Hong and Dr. Lim Guan Soon
4. Mentoring dates	5-9 December 2006. (Arrived Taipei 5 December; departed Taipei 9 December).
5. Location/Institutions	1. Bureau of Animal & Plant Health Inspection and Quarantine (BAPHIQ), Council of Agriculture, Executive Yuan, Taipei, Chinese Taipei (Dr. Kuo Ker Chung, Dr. Yen Chern Feng, and senior staff) 2. Agricultural Research Institute (ARI), Wufeng, Taichung, Chinese Taipei (Dr. Wang Chin Ling and senior staff)
6. People visited/concerned	1. Dr. Kuo Ker Chung, Dr. Yen Chern Feng, and senior staff (BAPHIQ). 2. Dr. Wang Chin Ling and senior staff (ARI). 3. Prof. Ko Chiun Cheng, National Taiwan University (NTU), Taipei.
7. Purpose	To evaluate the progress of the surveillance workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	Dr. Yen Chern Feng was the sole Chinese Taipei participant who attended the surveillance workshop held in Malaysia during May 2006. The mentoring team had discussions with her (and also other senior staff of BAPHIQ, ARI and NTU) to evaluate the progress of the surveys being undertaken. Visits were also made to the laboratories to assess the collections & facilities and to a flower wholesale market to observe the field operations being undertaken towards detection and interception of the Western Flower Thrips (WFT), a potential invasive alien species (IAS) of production and trade significance so far not found in Chinese Taipei. For detection of the WFT, numerous blue sticky traps were set up at strategic points in the wholesale

	market and checked regularly. Should the presence of any WFT be suspected, they will be sent to ARI for Dr. Wang Chin Ling (a thrips taxonomic expert) to identify and confirm. However, none has been found to date. This system of trapping thrips with blue sticky traps is also duplicated in several selected locations throughout the country in both wholesale markets and in farmers' fields. Dr. Yen explained that in general the survey activities for the four groups of sucking insect pests (leafminers, thrips, whiteflies and mealybugs) from a wide range of field crops have been progressing well and no serious problem was encountered. So far, these have been surveyed and collected from different locations in the Taipei and the Taichung provinces. Most specimens have been mounted and are ready for identification. Until the up-coming diagnostic workshops in early 2007 in Malaysia, it is envisaged that more surveys would be carried out periodically from more locations. The surveys would be island-wide and include some other surrounding small islands. All the survey activities are expected to be undertaken with funding from the local Government, including all transport costs and other support laboratory and field facilities. In ARI, thrips have received particular attention, particularly through the expertise service of Dr. Wang Chin Ling. She has built up a huge thrips collection mounted on slides for identification purposes and she plays an important role in conjunction with an on-going nation-wide detection and interception program for WFT in Chinese Taipei. Assurance was also given to the mentoring team that all groups of the specimens will be brought to the 2007 diagnostic workshops for identification, reconfirmation and other related studies.
• **Facilities and collected specimens**	The mentoring team visited the laboratories at ARI where collections of a wide range of pests (including leafminers, whiteflies, mealybugs and thrips) are being kept. In general, the laboratories are well-equipped, possess good support facilities, and contain excellent insect collections for training purposes, particularly those of thrips. Besides having good insect and mite taxonomic collections,

	ARI also has several taxonomic experts to help in identification tasks. In its collections are about 1,000,000 specimens and 2050 type specimens of various insect/mite groups. The institution also has provision for foreign scientists to visit and undertake taxonomic research. It also provides identification service at no charge. There are also available several insect screen houses where insect culturing and research work can, and are being undertaken.
• **Constraints**	Chinese Taipei did not experience any constraint to do surveillance as they have adequate funds provided by the Government. Thus, the staff of BAPHIQ and ARI are able to undertake comprehensive collection of thrips, leafminers, whiteflies and mealybugs from a wide range of different crops in various provinces of the country. The present pest well organized surveillance system on IAS in Chinese Taipei could serve to provide a model for some of the APEC economies to emulate.
• **Remarks and suggestions**	1. Explanation was made to Dr. Yen Chern Feng and staff of BAPHIQ, ARI and NTU on the objectives of the current APEC project mentoring visit and the purpose of the upcoming APEC follow-up 5-day diagnostic training workshops. It was made known to them that tentatively the diagnostic workshops are planned for February 2007 (for thrips and leafminers) and April 2007 (for whiteflies and mealybugs) and participants are expected to bring along national specimens for identification and other diagnostic work in the workshops. 2. For the up-coming workshops, Dr. Yen Chern Feng indicated that BAPHIQ/ARI would decide on who would participate in the workshops. Whoever participates would bring along all the needed specimens for the diagnostic activities.

Signature: …… ……
Name: …….. ……
Date:…… ……

APEC Mentoring Report: Indonesia

1. Project Title	**Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access**
2. Project Code	ATC 01/2006A
3. Persons conducting mentoring	Mr. Yusof Othman and Dr. Soetikno S. Sastroutomo
4. Mentoring dates	6 – 10 November, 2006. (Arrived Jakarta 6 November; depart Jakarta 10 November).
5. Location/Institutions	1. Directorate of Horticulture Protection, Directorate General of Horticulture, Jakarta, Indonesia (Soekirno, Anik Kustaryati, Cahyaniati) 2. Pest Forecasting and Monitoring Centre, Jatisari, Karawang (I Nyoman Raga and Tri Murniningtyas) 3. Department of Plant Protection, Bogor Agricultural University IPB), Bogor (Dr. Purnama Hidayat and Dewi Sartiani) 4. Horticulture Research Institute Lembang, Bandung (Anik Kustaryati and Tri Murniningtyas)
6. People visited	Mr. Soekirno Dr. Purnama Hidayat Mr. I Nyoman Raga Ms. Tri Murniningtyas Ms. Anik Kustaryati Ms. Cahyaniati Ms. Dewi Sartiani
7. Purpose	To evaluate the progress of the survey workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	Dr. Purnama Hidayat from Bogor Agriculture University and Mr. Soekirno from Directorate of Horticulture Protection attended the survey training workshop held in Malaysia during May 2006. The mentoring team meets with both of them and also their staff (Mr. I Nyoman Raga, Ms. Tri Murniningtyas, Ms. Anik Kustaryati, Ms. Cahyaniati, and Ms. Dewi Sartiani) in their laboratories as well as in the field (in Jatisari and Lembang). Mr. Soekirno explained that in general the survey activities for thrips and mealybugs have been progressing well and there were no serious problem. To date, specimens for these two sucking insect groups have been surveyed and collected from mango in 10 districts of the mango central production areas, in West Java (Indramayu, Majalengka and Ceribon), Central Java (Pemalang and Blora), East Java (Situbondo, Pasuruan and Probolinggo), and Bali (Buleleng and Karangasem). Pest surveillance on sweet pepper/paprika in East Java have been

	done and currently they are doing this in West Java. The mentoring team have the opportunity to follow Dr. Purnama and his team to do surveillance in Lembang. About 30,000 Ha of sweet pepper cultivation under the plastic screen house would be randomly surveyed. At least they have found 3-4 individual thrips per single flower. Leaf damage caused by this pest is clearly observed. For leafminers and whiteflies, many specimens have also been collected from West Java (through ACIAR Project) by Dr. Purnama and surveillance/specimen collection from other districts/provinces would be surveyed before the up-coming diagnostic workshops. All groups of the specimens will be brought to the diagnostic workshops for identification, reconfirmation and other related studies.
• **Facilities and collected specimens**	The mentoring team visited the office of Dr. Purnama where collection of leafminers, white flies, mealybugs and thrips are being kept. They have good collections of thrips and mealybugs. Ms. Dewi, one of Dr. Purnama's staff did a MSc course on taxonomy of mealybugs in Indonesia under the supervision of Dr. Gillian Watson (our resource person for the April 2007 course). The laboratory facilities of IPB are well-equipped with a good insect collections for teaching and there are available numerous insect screen houses where insect culturing and research work are undertaken. It is clear that the physical facilities and capability of the staff of IPB are in unquestionable position to carry out the survey and specimen collections. The mentoring also visited the office of Ms. Tri Murtiningtyas (staff of Mr. Soekirno) in Jatisari, Karawang. They have a very good collection of mango pests including thrips and mealybugs. They are currently sorting out the collected specimens before preparing slides.
• **Constraints**	Indonesia did not experience any constraint due to the limited fund allocation provided by the project to support the field survey and collection of specimens. This is because they have other survey-related projects where the funding (from the government as well as from ACIAR) can partially help the APEC project survey and specimen collection. Thus, both Dr. Purnama and Mr. Soekirno are able to undertake a more comprehensive collection of thrips, leafminers, whiteflies and mealybugs from a wide range of different crops in different provinces of the country. The only constraint would be to get chemicals for preparing slides as well as micro pins for preparing specimens. They need to purchase this from overseas and sometimes it will takes more than three months to arrive.
• **Remarks and suggestions**	1. Explanation was made to Dr. Purnama and Mr. Soekirno on the objectives of the current APEC project mentoring visit and the purpose of the upcoming APEC follow-up 5-day diagnostic training

	workshops. It was made known to them that tentatively the diagnostic workshops are planned for February 2007 (for thrips and leafminers) and April 2007 (for whiteflies and mealybugs) and participants are expected to bring along national specimens for identification and other diagnostic work in the workshops. 2. For the up-coming workshops, Dr. Purnama indicated that he would only participate in one of the workshops, i.e. in February. For the April workshop, he will ask Dewi to participate and would bring along all the needed specimens for the diagnostic activities. Mr. Soekirno indicated that he will send his staff (selected from the three staff mentioned above) to attend both workshops 3. Several sessions of discussions were held with Dr. Purnama and his team on how further survey for more specimens are to be carried out, including how they should be properly stored to ensure the specimens do not deteriorate prior to the up-coming diagnostic workshops. 4. It was agreed that the APEC project fund allocated to support the survey and specimen collection in Indonesia will be provided to Mr. Soekirno to coordinate and manage. He will disburse whatever is required by Dr. Purnama accordingly.

Signature: …… ……
Name: ……. ……
Date:…… ……

APEC Mentoring Report: Malaysia

1. Project Title	**Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access**
2. Project Code	ATC 01/2006A
3. Persons conducting mentoring	Mr. Yusof Othman and Mr. Syed Abdul Rahman
4. Mentoring dates	14 – 16 November, 2006. (Arrived Cameron Highlands on 14 November; depart Cameron Highlands on 16 November).
5. Location/Institutions	1. Plant Protection and Quarantine Division, Kuala Lumpur (Ms. Wan Normah Wan Ismail, Mr. Mohd Jaffar Kadir, and Mr. Nordin Mamat) 2. Plant Protection and Quarantine Division, Cameron Highlands (Mr. Mohd Jaffar Kadir, Mr. Chua Lee Seng, Mr. Khairuddin Ahmad)
6. People visited	Ms. Wan Normah Wan Ismail Mr. Mohd Jaffar Kadir Mr. Nordin Mamat Mr. Chua Lee seng Mr. Khairuddin Ahmad Mr. Nik Hamadi Ms Wong Wang Cheng All the 13 state surveillance teams (40 peoples)
7. Purpose	To evaluate the progress of the survey workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	Mr. Mohd Jaffar Kadir had shown the thrips, mealybugs, whiteflies and leafminers collections in the Plant Protection and Quarantine Division, Kuala Lumpur. There are about 500 slides and pin specimens in the collection. The collection are well kept with humidifyier and air condition. The identification of about a third of these specimens have not been varified. Mr. Jaffar indicate that these specimen will be brought along during the proposed identification workshop. The participants from the last Pest surveillance workshop held in May 2006 (Mr Khairuddin Ahmad and Mr. Nik Hamadi) reported that the survey on mango pests had been carry out throughout Peninsular Malaysia (11 states) include thrips and mealybugs. The survey were conducted in accordance to the ISPM 8 standards for the preparation of host-pest list. Currently 13 states surveillance teams had been formed to conduct surveillance on 12 crops i.e crysanthemum, ochids, mango, pineapples, papaya, durian, mangoesteen, water melon, starfruits, guava, tomato and bell peper/paprika. Training on survey

	methology, collection techniques and specimen preservation were held in Cameron Highlands from 13-17 November 2006. Survey will be carried out in December 2006 to February 2007 in all the 13 states of Malaysia. This survey will be coordinated by Mr. Khairuddin Tahir on all the four target pests. The collected specimens will be used in the 2 workshop in 2007 for identification training and other activities.
• **Facilities and collected specimens**	Visit to the plant protection and Quarantine Division in Kuala Lumpur where the collection of leafminers, white flies, mealybugs and thrips are being kept. They have some good collections of thrips and mealybugs collected by Mr. Yusof Othman. Leafminers were collected by the State Crop Protection Officers and whiteflies by Mr. Omar Muhamad. These specimen is definitely a good specimens for the worhshop in February and April 2007. To date all the equipments and chemical for the survey and collection of specimens had be bought and distributes to the state surveillance teams. Some of the consumable items are funded by this project.
• **Constraints**	Malaysia did not experience any constraint due to the limited fund provided by the project to support the field survey and collection of specimens. The survey activities funded by the government partially support APEC survey and specimen collection project. The only constraint they experience is in getting choral hydrate for preparing hoyer's media for the slides. However, this had been solve.
• **Remarks and suggestions**	1. The mentoring team brief the workshop in Cameron Highlands on the objectives of the current APEC project mentoring visit and the purpose of the upcoming APEC follow-up 5-day diagnostic training workshops. It was made known to them that tentatively the diagnostic workshops are planned for February 2007 (for thrips and leafminers) and April 2007 (for whiteflies and mealybugs) and participants are expected to bring along national specimens collection for identification and other diagnostic work in the workshops. 2. For the up-coming workshops, Malaysia will send the appropriate participants to the workshop with national collected specimens from the existing collection and survey of the 12 crops. Several observers will also participate in the workshop since it will be help in Malaysia.

Signature: …… ……
Name: ……. ……
Date:…… ……

APEC Mentoring Report: The Philippines

1. Project Title	**Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access**
2. Project Code	ATC 01/2006A
3. Persons conducting mentoring	Mr. Yusof Othman and Dr. Soetikno S. Sastroutomo
4. Mentoring dates	22 – 25 November, 2006. (Arrived Manila 22 November; depart Manila 25 November).
5. Location/Institutions	1. Crop Protection Division, Bureau of Plant Industry (Wilma Quaterno, Nestor E. Rivera and Dr. Hernani G. Goles) 2. Coffee Research Centre, Cavite State University 3. Flower farms, Silang, Cavite 4. Crop Protection Cluster, University of the Philippines, Los Banos (Dr. E. Ocampo, Dr. Aurora M. Baltazar) 5. National History Museum, UPLB 6. Insect Collection, IRRI (Dr. K.L. Heong)
6. People visited	Dr. Bonifacio Cayabyab Dr. E. Ocampo Dr. Aurora M. Baltazar Dr. K.L. Heong Ms. Wilma Quaterno Mr. Nestor E. Rivera Dr. Hernani G. Goles
7. Purpose	To evaluate the progress of the survey workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	Dr. Bonifacio Cayabyab from Crop Protection Cluster, UPLB and Ms. Wilma Quaterno from Crop Protection Division, BPI attended the survey training workshop held in Malaysia during May 2006. The mentoring team meets with both of them and also their staff and counterparts in their laboratories as well as in the field (Silang and Cavite). Ms. Wilma and Dr. Bonifacio reported that the general survey activities for the four group on insects pests (thrips, leaf miners, whiteflies and mealybugs) have been progressing well and there were no serious problem. To date, specimens for these insect pest groups have been surveyed and collected from several provinces (Pampanga, Tarlac, Pangasinan, Cavite, Tagaytay and Laguna) For thrips and mealybugs, additional specimens would be collected from Mindanao. Surveillance/specimen collection for the four group of insects would also be conducted from other districts/provinces before the up-coming diagnostic workshops. All specimens for the target groups will be brought to the diagnostic

	workshops for identification, reconfirmation and other related studies.
• **Facilities and collected specimens**	The mentoring team visited the office of Ms. Wila where collection of leafminers, white flies, mealybugs and thrips are being kept. They have good collections of these insect pests. They are currently sorting out the collected specimens before proceed with the slides preparation. The mentoring also visited the office of Dr. Bonifacio at UPLB. He has very good collection insect pests of pineapples (from Laguna) and coffee (from Cavite), including thrips, mealybugs and mites. Insect collection of IRRI was also visited and they have a very excellent collection of insect pests.
• **Constraints**	The Philippines did not experience any constraint with the surveillance as they have government fund for annual surveillance work. Both Dr. Bonifacio and Ms. Wilma are able to undertake a comprehensive collection of thrips, leafminers, whiteflies and mealybugs from cut flowers and pineapples as well as from corn. The only constraint they experience is in getting chemicals for preparing slides and micro pins for preparing specimens. They need to purchase this from overseas and sometimes it will take more than three months to arrive.
• **Remarks and suggestions**	1. The mentoring team brief Dr. Bonifacio and Ms. Wilma on the objectives of the current APEC project mentoring visit and the purpose of the upcoming APEC follow-up 5-day diagnostic training workshops. It was made known to them that tentatively the diagnostic workshops are planned for February 2007 (for thrips and leafminers) and April 2007 (for whiteflies and mealybugs) and participants are expected to bring along national specimens collection for identification and other diagnostic work in the workshops. 2. Several sessions of discussions were held with Dr. Bonifacio and his team to continue with the survey for more specimens. They are taught on how to properly store these specimens to ensure they do not deteriorate prior to the up-coming diagnostic workshops and the data required under the ISPM 8 for the preparation of the host-pest lists. 5. It was agreed that the APEC project fund allocated to finance the surveys and specimen collections for The Philippines will be given to Dr. Bonifacio to coordinate and manage. They would be using this limited fund to complement the government fund for doing surveillance in Mindanao.

Signature: …… ……
Name: Soetikno S. Sastroutomo and Yusof Othman

ATC 01/2006A – Capacity Building in Surveillance & Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economist for Improved Market Access

Date: 13th November 2006

APEC Mentoring Report: Singapore

1. Project Title	**Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access**
2. Project Code	ATC 01/2006A
3. Persons conducting mentoring	Mr. Yusof Othman and Dr. Lum Keng Yeang
4. Mentoring dates	20 – 22 November, 2006. (Arrived Cameron Highlands on 20 November; depart Cameron Highlands on 22 November).
5. Location/Institutions	1. Mr Fong Chin AVA Singapore
6. People visited	Mr. Foo Chin Lui Mr. Jimmy Goh
7. Purpose	To evaluate the progress of the survey workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	The participants from the last Pest surveillance workshop held in May 2006 (Mr. Foo Chin Lui) reported that the surveys and collections of thrips and whiteflies had been carried out in Singapore. They had shown the mentoring team the report and slides they had prepared for thrips and whiteflies. However, mealybug are still kept in 70% alcohol and later will be used to prepare slide mounting. Presently, the collection of leafminer doesn't yield any specimens yet where most of the leaves with symptom collected doesn't emerged to adults. The microscopic slides that had been prepared for thrips and whiteflies can be used as working specimens for the proposed workshop in 2007 Mr. Foo and his surveillance team had been briefs by the mentoring team on the best methods to collect mealybugs and leafminers. We had visit several farms around Lim Chu Kang agroteknology park and manage to demonstrate various techniques to collect mealybugs and leafminers. They indicated that the collection of these specimens will be carry out before the workshop.
• **Facilities and collected specimens**	Singapore had a good collection of thrips and whiteflies. They had collected mealybugs in 70% alcohol but no leafminers. With the short training in the field, they will manage to collect leafminers especially on vegetables. These specimens will be used as working/references specimens for the worhshop in February and April 2007. Singapore had no problem in getting the equipments and chemical for the survey and collection of specimens.

• **Constraints**	Singapore did not experience any constraint in fund to support the field survey and collection of specimens. The survey activities funded by the government partially support APEC survey and specimen collection project.
• **Remarks and suggestions**	1. The mentoring team had brief the Mr Foo and the surveillance team on the objectives of the current APEC project mentoring visit and the purpose of the upcoming APEC follow-up 5-day diagnostic training workshops. It was made known to them that tentatively the diagnostic workshops are planned for February 2007 (for thrips and leafminers) and April 2007 (for whiteflies and mealybugs) and participants are expected to bring along national collected specimens collection identification and other diagnostic work in the workshops. 2. For the up-coming workshops, Singapore requested that the invitation letter should indicate one participant from the surveillance team and another from the Laboratory. They are willing to bring all the collected specimens as working sample at the workshop.

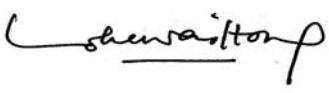
Signature: …… ……
Name: Yusof Othman Dr Lum Keng Yeang

Date: 1 December 2006

APEC Mentoring Report: Thailand

1. Project Title	Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Member Economies for Improved Market Access
2. Project Number	ATC 01/2006A
3. Persons conducting mentoring	Dr. Loke Wai Hong and Dr. Lim Guan Soon
4. Mentoring dates	28 – 30 September 2006. (Arrived Bangkok 27 September; departed Bangkok 3 October).
5. Location/Institutions	Department of Agriculture (DOA), Bangkok, Thailand
6. People visited	Dr. Amporn Winotai and Mr. Roumchaiapigul Somrouy
7. Purpose	To evaluate the progress of the project inception workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	Both Mr. Somrouy and Ms. Srijumnun Srijuntra attended the project inception training workshop held in Malaysia in May 2006. The mentoring team could only meet with Mr. Somrouy as Ms. Srijuntra was away on duty travel during the team's visit. This, however, did not pose any problem since both Mr. Somrouy and Ms. Srijuntra are both from the same department and have been working closely on the project activities. Ms Srijuntra had also briefed Mr. Somrouy thoroughly. Before her trip. Mr. Somrouy explained that in general the survey activities have been progressing well. As a start, specimens of thrips, leafminers and whiteflies on basil leaves around the Bangkok region have been surveyed and collected. Efforts are on-going to survey and collect more specimens from other areas in the provinces, including those of mealybugs. Mr. Somrouy has given assurance that all groups of the specimens will be brought to the upcoming diagnostic workshops for identification and other related studies. Mr. Somrouy also pointed out that basil leaves have been selected because the crop is an important export crop of Thailand and currently they have trade issues to smoothen out for this crop especially with regard to market access to Europe.
• **Facilities and collected specimens**	The mentoring team also visited the on-going work and the laboratory facilities and also inspected the speciments of thrips, leafminers and whiteflies which have been collected so far. These were preserved in 75% alcohol. Detailed examination of the different groups of pest specimens showed

	them to be in good condition. It is clear that the physical facilities and capability of the staff at DOA are well positioned to carry out the surveys and specimen collections. This augurs well for their participation in the training workshops scheduled for Year 2 (2007) of this project.
• **Constraints**	Because of limited fund allocation by the project to support the field surveys and collection of specimens, it is not possible to undertake a more extensive and representative collection of thrips, leafminers, whiteflies and mealybugs from a wide range of different crops over the diverse ecological conditions in the different parts of the country.
• **Remarks and suggestions**	1. Explanation was made to Mr. Somrouy on the objectives of the current APEC project mentoring visit and the purpose of the upcoming follow-up 5-day diagnostic training workshops. It was made known to him that tentatively the diagnostic workshops are planned for February 2007 (for thrips and leafminers) and April 2007 (for whiteflies and mealybugs) and participants are expected to bring along national specimens for identification and other diagnostic work in the workshops. 2. For the up-coming workshops, Dr. Amporn (Senior Project Officer in Charge) indicated it would be desirable to expose more national staff in taxonomic training. She proposed that instead of the same two participants continuing to attend both the workshops, each should participate only in one of the up-coming workshops along with another colleague. 3. Lengthy discussions were held with Mr. Somrouy on how further survey for more specimens are to be carried out, including how they should be properly stored to ensure the specimens do not deteriorate prior to the up-coming diagnostic workshops. Since Ms. Srijuntra was not present, Mr. Somrouy gave the assurance that he would convey all the requirements in detail to Ms. Srijuntra so that all the needed tasks will be undertaken properly. available 4. To ensure better coverage of the specimen collection survey, more funding should be allocated in similar future programmes.



Signature:
Name: Dr Loke Wai Hong
Date: 12 October 2006

APEC Mentoring Report: Viet Nam

1. Project Title	**Capacity Building in Surveillance and Diagnosis for Leafminer, Whitefly, Thrips and Mealybug Pests in Developing APEC Economies for Improved Market Access**
2. Project Code	ATC 01/2006A
3. Persons conducting mentoring	Dr. Soetikno S. Sastroutomo and Dr. Lim Guan Soon
4. Mentoring dates	26–30 November, 2006. (Arrived Ha Noi 26 November; departed Ha Noi 30 November).
5. Location/Institutions	1. National Institute of Plant Protection (NIPP), Ministry of Agriculture and Rural Development, Ha Noi, Viet Nam (Dr. Nguyen Hon Son, Dr. Nguyen Van Liem) 2. Plant Protection Department (PPD), 6 Tran Quang Dieu Street, Dong Da District, Ha Noi, Viet Nam (Ms. Tran Thi Xuyen)
6. People visited/concerned	1. Dr. Nguyen Hon Son 2. Dr. Nguyen Van Liem 3. Ms. Tran Thi Xuyen
7. Purpose	To evaluate progress of the survey workshop follow-up activities and to advise on overcoming any constraints where needed.
8. Report on outcomes:	
• **Progress of work**	Dr. Nguyen Van Liem from NIPP and Ms. Tran Thi Xuyen from PPD attended the survey training workshop held in Malaysia during May 2006. The mentoring team had discussions with them (and also Dr. Nguyen Hon Son, Vice Director) to evaluate the progress of the survey being undertaken, including visit to the laboratories and the fields. They explained that in general the survey activities for leafminers and thrips from chrysanthemum fields have been progressing well and no serious problem was encountered. To date, these two insect groups have been surveyed and collected from different locations in Hanoi. All specimens have been mounted and are ready for identification. Pest surveillance (including white flies) on citrus in Ha Noi

	and the neighbouring provinces has been done through internal project activities funded by the Government. In relation to this, the mentoring team visited two citrus orchards in Ha Noi. Currently the surveillance has been expanded to, and is continuing in South Viet Nam. For mealybugs, many specimens have also been collected from different crops and wild plants. More surveys would be done in December before the up-coming diagnostic workshops. PPD has a very good collection of mango pests including thrips and mealybugs. Although Ms. Tran Thi Xuyen is currently busy writing her M.Sc. thesis, she however has managed with the help of a technician to sort out the collected specimens in order to mount them on slides. She has indicated that many more specimens will be collected from South Viet Nam in due course before the up-coming diagnostic workshops in Malaysia. Assurance was also given to the mentoring team that all groups of the specimens will be brought to the diagnostic workshops for identification, reconfirmation and other related studies.
• **Facilities and collected specimens**	The mentoring team visited the laboratories-cum-office where collections of leafminers, white flies, mealybugs and thrips are being kept. In general, the laboratory facilities (especially in NIPP) are well-equipped with good insect collections for training purposes, particularly those of thrips and leafminers. There are also available several insect screen houses where insect culturing and research work can, and are being undertaken.
• **Constraints**	Viet Nam did not experience any constraint to do surveillance as they have additional funds provided by the government as well as from several donor agencies (e.g. ACIAR, Australia and SDC, Switzerland) to support the field surveys and collections of specimens. Thus, both Dr. Van Liem and Ms. Xuyen are able to undertake a more comprehensive collection of thrips, leafminers, whiteflies and mealybugs from a wide range of different crops in different provinces of the country.

	The only constraint for them would be to get chemicals (Hoyer's medium) for preparing slides as well as micro pins for mounting tiny specimens. The mentoring team would assist them in obtaining these materials (e.g. Hoyer's medium from DOA, Kuala Lumpur, Malaysia). Arrangements would be made for Malaysian participants to pass over the materials to the Vietnamese participants when they all attend an ASEAN training course in Bangkok in December.
• **Remarks and suggestions**	1. Explanation was made to Dr. Nguyen Van Liem and Ms. Tran Thi Xuyen on the objectives of the current APEC project mentoring visit and the purpose of the upcoming APEC follow-up 5-day diagnostic training workshops. It was made known to them that tentatively the diagnostic workshops are planned for February 2007 (for thrips and leafminers) and April 2007 (for whiteflies and mealybugs) and participants are expected to bring along national specimens for identification and other diagnostic work in the workshops. 2. For the up-coming workshops, Dr. Van Liem indicated that he would only participate in one of the workshops, i.e. in February. For the April workshop, he will ask his staff to participate and would bring along all the needed specimens for the diagnostic activities. 3. It was agreed that the APEC project fund allocated to support the surveys and specimen collections will be provided to Dr. Van Liem to coordinate and manage. He will be responsible to disburse whatever is required by Ms. Xuyen.

Signature: …… ……
Name: ……. ……
Date:…… ……