FAO INTER-COUNTRY PROGRAMME
TO STRENGTHEN IPM TRAINING
AND SUSTAIN IPM PRACTICES AMONG VEGETABLE FARMERS
IN SOUTH AND SOUTH-EAST ASIA

BACK-TO-OFFICE REPORT

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REPORT OF FINAL MEETING

FAO TCP Project (TCP/RAS/3311)
"Capacity Building for Spread Prevention and Management of Cassava Pink Mealybug in the Greater Mekong Subregion"

4-8 November 2013
Ho Chi Minh City, Vietnam

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Date: 27 November 2013		**Date:**

Places Visited and Dates: **LTC:** HCMC and Tay Ninh (4-7 November 2013); 8th November returned to Kuala Lumpur, Malaysia.
TC: HCMC and Tay Ninh (4-7 November 2013); 8th/9th November returned to Bangkok/Nakhon Ratchasima, Thailand.
For specific details on itinerary and activities, see Annex 1.

Purpose of Visit: Participate/Resource Persons in "Final Meeting of FAO TCP Project (TCP/RAS/3311)", 5-7 November, 2013.

Programme Entity/Project: TCP/RAS/3311

Summary:
The FAO TCP Final Meeting, held from 5-7 November, 2013 in Ho Chi Minh City, was to review the project's progress and achievements, lessons learnt, and to formulate ways forward beyond the project tenure. Thirty-one participants attended the Meeting, comprising 21 representatives from the Governments and National IPM Programmes of GMS countries (Cambodia, China, Laos, Myanmar, Thailand and Vietnam); four participants from regional/international research & development organizations whose mandates have bearing to the project; and six FAO staff and consultants.

The main activities included: (i) Presentations and discussions on TCP activities and results to date with focus on various aspects of CM, its management with A. lopezi parasitoid, other cassava pests of potential threat in the region, as well as issues relating to biocontrol agents/products and GIS mapping on spread of CM and its parasitoid, (ii) Field visit to Tay Ninh province to observe and learn about CM and mass rearing of A. lopezi, and (iii) Participants working in groups to formulate ways forward beyond this project.

The final outputs are 'Recommendations on Ways Forward' addressing two distinct situations: (i) countries where CM is currently absent but facing potential threat of incursion because the CM is already present in some countries in the region, as well as for those with CM but A. lopezi parasitoids are still absent, and (ii) countries where both CM and A. lopezi parasitoids are present.

For summary of meeting objectives, agenda and presentation/discussion results: http://www.vegetableipmasia.org/News/News60.html

Key words: *TCP Final Meeting, Cassava mealybug (Phenacoccus manihoti), Anagyrus lopezi parasitoid, Ways forward beyond TCP Project.*

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- All FAO Representatives & FAO-IPM National Experts/Project staff in Cambodia, China PR, Lao PDR, Thailand and Vietnam.
- Mr. Prabhat Kumar (AIT).

Acronyms

ABC	ASEAN biocontrol for sustainable agrifood systems
ADB	Asian Development Bank
AIT	Asian Institute of Technology (Thailand)
AMS	ASEAN Member States
APPPC	Asia and Pacific Plant Protection Commission
ASEAN	Association of Southeast Asian Nations
BCA	Biological control agents
BM	Banteay Meanchey (Cambodia)
BTM	Battambang (Cambodia)
CABI	CAB *International*
CIAT	International Center for Tropical Agriculture
CM	Cassava mealybug (*Phenacoccus manihoti*)
CPMC	Community Pest Management Center
DAFO	District Agriculture and Forestry Office (Laos)
DOA	Department of Agriculture (China, Laos, Thailand)
DOAE	Department of Agriculture Extension (Thailand)
DPPSPS	Department of Plant Protection Sanitary and Phytosanitary (Cambodia)
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GIS	Geographical Information System
GIZ	German International Cooperation
GMS	Greater Mekong Subregion
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ISPM	International Standard for Phytosanitary Measures
LTC	Lead Technical Consultant (of FAO TCP Project)
LTO	Lead Technical Officer
MARD	Ministry of Agriculture and Rural Development (Vietnam)
MOA	Ministry of Agriculture (China, Thailand)
NATESC	National Agro-tech Extension & Service Center
PMU	Project Management Unit
PDOA	Provincial Department of Agriculture (Cambodia)
PPC	Plant Protection Center (Laos)
PPD	Plant Protection Department (Vietnam)
PPSD	Plant Protection Sub-Department (Vietnam)
PRR	Pesticide risk reduction
RPPC	Regional Plant Protection Center (Vietnam)
SAVGIS	Freeware GIS available online at www.savgis.org
TC	Training Consultant (of FAO TCP Project)
TCP	Technical Cooperation Programme
TOT	Training of Trainers
TTDI	Thai Tapioca Development Institute

1. Background

Cassava is a major crop used for human consumption, animal feed and bioenergy production. In the Greater Mekong Subregion (GMS), about 3 million smallholder farmers derive their livelihoods from cassava production. In early 2008, incursion by *Phenacoccus manihoti* or cassava pink mealybug (CM), devastated extensive cassava areas in Thailand. Subsequently, it also invaded some other GMS countries, namely Cambodia (2009), Laos (2011), and Vietnam (June 2012).

To combat the CM menace, Thailand introduced from Africa the parasitoid *Anagyrus lopezi* for biocontrol of the mealybug. This, as well as releases of local predatory lacewings, together with ecological pest management training efforts of field extension workers and farmers, have helped to effectively control the CM problem.

Adopting this rationale and in response to calls for support, FAO formulated a regional TCP project entitling "*Capacity Building for Spread Prevention and Management of Cassava Pink Mealybug in the Greater Mekong Subregion*" to assist the GMS countries develop pest-spread prevention strategies and ecological biocontrol options to manage the CM. The project partner countries included Cambodia, China, Laos, Thailand and Vietnam and the main thrusts of the assistance were aimed at introducing *A. lopezi* parasitoids from Thailand to partner countries where the parasitoid is absent and to strengthen farmer training programmes to promote biocontrol and IPM of CM among the smallholder farmers. Expected project outcomes included fortification of the cassava production industry, improving the livelihoods of cassava farmers, protecting farm communities and the environment from pesticide contamination, preserving the agro-biodiversity and enhancing human capital development. The project also aimed to provide technical assistance to sustainably intensify cassava production through effective management of the CM pest.

FAO, in launching the TCP project, held an Inception Workshop on 31 May - 2 June, 2011 in Bangkok. The workshop discussed and detailed out concrete work plans for follow-up implementation in the partner countries, guided by (i) the strategies as outlined in the project document and (ii) knowledge of the most up-to-date problem situation gained from feedback in the workshop.

Upon formulation of their respective work plans, all the partner countries have since implemented a range of project activities. At regional level, Thailand with immense experience and expertise in combatting the CM, provided invaluable assistance to the other partner countries in two training activities; the first on identification of CM and mass rearing of *A. lopezi*, and the second on curriculum development for IPM-FFS and TOT on cassava production and CM management. Thailand also provided *A. lopezi* parasitoids to countries needing the beneficial agent. On the other hand, AIT has helped with developing a geospatial mapping information system. For country-specific activities, these included importation of *A. lopezi* parasitoids for mass rearing and field releases, baseline survey of CM and its parasitoid, monitoring and impact assessment of *A. lopezi* parasitoid, organizing TOT and Subject-Matter Training Workshops for institutional staff, conducting FFS to train farmers, and implementation of FFS by farmers. With accomplishments of all these activities for more than two years since project commencement, the partner countries have gained much from the FAO assistance in developing pest-spread prevention strategies and ecological pest management approaches for CM management. The project has also facilitated natural biocontrol options for managing CM through releases of

predatory lacewings and building on existing IPM research and training networks across the GMS.

To date, much has taken place, hence the need to review what were the achievements, the lessons learnt, as well as to plan further on the ways forward beyond the project tenure. All these aspects were addressed in the Final Meeting of the TCP project held in Ho Chi Minh City from 5-7 November 2013. The proceedings and findings are herewith reported below.

2. Programmes and Participants of Final Meeting

A total of 31 people participated in the Final Meeting, comprising 21 representatives from the Governments and National IPM Programmes of the following GMS collaborating countries, Cambodia (2 participants), China (4 participants), Laos (2 participants), Myanmar (1 participant), Thailand (4 participants) and Vietnam (8 participants); four participants from selected regional/international organizations (CIAT, CABI, AIT and GIZ-ASEAN-BCA project) whose mandates also cover cassava-related or biocontrol activities; and six FAO staff and consultants. The list of participants, including their contact details, is as given in *Annex 2*.

The main activities of the Final Meeting included presentations of work experiences, field visit and working group session, as outlined below.

i. Presentations and discussions on various aspects of the CM, in particular experiences on its management, including the deployment of *A. lopezi* parasitoid. Also considered were other pests of potential threat to cassava in the region, management of invasive species, regulatory harmonization for application of biocontrol products in Southeast Asia, as well as GIS to provide spatiotemporal analysis of CM and *A. lopezi* parasitoid spread in the GMS,

ii. Field visit to cassava crops in Tay Ninh and to observe mass rearing of CM and *A. lopezi* parasitoids.

iii. Participants forming two working groups to brainstorm and develop ways forward: (i) for countries where CM is currently absent but facing potential threat of incursion because the CM is already present in some countries in the region, as well as for countries with CM but *A. lopezi* parasitoids are still absent, and (ii) for countries where both CM and *A. lopezi* parasitoids are present.

The detailed workshop programmes on presentations and working groups, field trip, timing of the specific activities and the people involved as chairpersons are as given in *Annex 3*.

3. Opening Session

Because Mr. Nguyen Xuan Hong, Director General of PPD-MARD had to be away on urgent official matter, the welcome and opening address was delivered on his behalf by the Deputy DG, Mr. Ngo Tien Dung. After extending a warm welcome to all delegates present, Mr. Dung expressed deep thanks for the privilege given to Vietnam to host this important Final Meeting of the FAO TCP Project on “Capacity Building for Spread Prevention and Management of Cassava Pink Mealybug in the Greater Mekong Subregion”. Appreciation on behalf of PPD-MARD was also extended to FAO project staff and consultants, specialists from international and donor

agencies, and delegates of collaborating GMS countries for coming to participate and share their experiences on CM management with Vietnam. Special thanks were accorded to FAO for past support and close cooperation with Vietnam in jointly organizing this Final Meeting.

Mr. Dung then briefly traced the CM development in the GMS, highlighting that it is a serious pest with first incursion in Thailand in 2008 that quickly spread to several neighboring countries to adversely affect millions of rural poor in the GMS whose livelihoods depended on cassava, a major crop used for human consumption, animal feed and bioenergy production in the region. Recognizing the importance of cassava production to sustain the livelihoods and economies in the GMS, and after about two years of implementation of the FAO TCP Project, participants have gathered here and for next three days will appraise the achievements and experiences gained to date. Also for this purpose is included a field trip to Tay Ninh province where serious CM infestation occurred last year to see what the Vietnamese Government has done to combat the outbreak. He also pointed out that recent estimates have indicated some developed countries (e.g. South Korea) will continue to have higher demand to import cassava. Hence, the effective protection from CM to enhance sound development of the cassava industry would be crucial to contribute towards further improvements in the livelihoods of cassava growers in the GMS economies.

In closing, he envisaged that this Final Meeting, guided by the lessons learnt, will be able to chart the ways forward for follow-ups at both national and international levels. He then thanked all participants for attending and wished everyone a highly constructive and productive meeting and also an enjoyable stay in Vietnam.

Next, Mr. Jan W. Ketelaar (CTA, FAO Vegetable IPM Programme) welcomed all present and expressed thanks to those who have put in great efforts in organizing this Final Meeting. Special thanks were accorded to Vietnam for hosting and also all local support arrangements rendered, in particular the field visit to Tay Ninh province on 6 November. Tracing briefly the project progress over the past two years, he highlighted that the GMS partner countries have successfully implemented a range of project activities. At country-specific levels, some key achievements have included importation of *A. lopezi* parasitoids for mass rearing and field releases, organizing TOT for institutional staff, conducting FFS to train farmers, and implementation of FFS by farmers. At regional level, Thailand with immense experience and expertise in combatting the CM has played key role in assisting other partner countries - supplying *A. lopezi* parasitoids plus how to mass rear it, providing training on CM identification, and development of curriculum for IPM-FFS and TOT on cassava production and CM management. On the other hand, AIT has helped with developing a geospatial mapping information system. Accomplishments of these activities have enabled partner countries to benefit from the FAO assistance in developing pest-spread prevention strategies and ecological pest management approaches for CM management. Also, the project has facilitated natural biocontrol options for managing CM through building on existing IPM research and training networks across the GMS.

Objectives for this Final Meeting were then highlighted, i.e. to review and appraise the situations/distributions of CM and *A. lopezi* in the GMS, compile the lessons learnt, and to develop strategies and plans relating the ways forward which national/international organizations can consider to embark on. Following this, he walked the participants through the meeting programmes, highlighting in particular the importance and purpose of the field visit to Tay Ninh province to observe first-hand CM occurring there and what is being done on parasitoid mass rearing for releases to manage CM.

In concluding, he once again thanked everyone for making efforts to participate in spite of their busy schedules and wished every success for the Final Meeting to achieve its objectives.

Thereafter, Mr. Lim Guan Soon (Lead Technical Consultant, FAO TCP Project) gave a presentation on the background and progress overview of the project, covering why and how the project came about, achievements of the activities implemented, and appraisal of the CM problem plus what should be done next. He highlighted that the TCP Project was triggered primarily by CM incursion that devastated extensive cassava areas in Thailand in 2008, wherein the country in 2009 imported from IITA-Benin *Anagyrus lopezi* parasitoid to combat it. This biocontrol approach plus releases of local predatory lacewings, together with ecological pest management training efforts of field extension workers and farmers, proved highly effective in controlling the CM and preventing its further spread.

Adopting this rationale and in response to calls for support from the GMS countries on concern of its potential spread in the region, FAO formulated a regional TCP project to assist the countries develop pest-spread prevention strategies and ecological biocontrol options to manage the CM. The main project objectives and outputs included (i) providing technical support to strengthen understanding and management of CM and introductions of *A. lopezi* parasitoid from Thailand where needed, (ii) training GMS countries to be capable in managing CM with *A. lopezi* parasitoid, and (iii) enhancing capacities of extension workers to conduct FFS on CM and farmers to manage CM with biocontrol/IPM options. The GMS partner countries collaborating included Cambodia, China, Laos, Thailand and Vietnam and the project duration from February 2010 to December 2013.

Many activities were implemented, beginning with the Inception Workshop at regional level to formulate project work plans, followed by CM Identification and Management Workshop and Curriculum Development Workshop to develop preparedness in collaborators to deal with CM in anticipation of incursions. To date, except for China, CM incursions have occurred in Cambodia (2009), Laos (2011), Vietnam (2012), and Indonesia (2010, reported by CIAT). Other regional activities undertaken were technical backstopping by Thailand DOA and DOAE, including providing *A. lopezi* parasitoids to partner countries, GIS mapping on risk assessment by AIT, and this TCP Final Meeting.

Many in-country activities were also achieved. These included surveillance for CM and implementing phytosanitary measures against it, raising awareness of CM through publicity media, parasitoid introductions, mass rearing, releasing and impact assessments, conducting TOT, subject-matter specialist workshop, stakeholder meetings, backstopping training/visits including training on CM identification/spread prevention, FFS plus farmer-managed demonstration fields/farmer field days, as well as farmer congress (For more details, see *Annex 4*).

Based on CM spread-trend in both GMS and Africa, it seems likely that other GMS/Asian countries will face future incursions by CM, primarily due to their proximity or sharing a contiguous land mass. Of immediate concern are Myanmar and China which are just next to CM-infested countries. They need to be vigilant and have strict quarantine measures to intercept contaminated carriers and also a surveillance system to detect CM early for timely actions to prevent widespread buildup. Whichever has CM could readily spread it to the Indian subcontinent.

Anagyrus lopezi is an excellent parasitoid capable of providing effective control of CM, as clearly demonstrated in Africa and more recently in Thailand. From lessons of these proven successes, countries facing CM incursions in future should immediately import *A. lopezi* for multiplication

and releasing into infested areas. Doing so coupled with farmer training would give the best chance of early CM control and to minimize crop losses. Because CM can build up rapidly and spread far and wide over many countries, regional/international cooperative efforts through support of international agencies would play a key role and merit serious consideration. Also, sound research to enhance better understanding of CM, its ecology and management, will continue to be needed from contributions of national/international research agencies

4. Technical Sessions and Presentations

A total of nine presentations were delivered: five country reports on the achievements of activities implemented, including the status of CM in each nation from Cambodia, China, Laos, Thailand and Vietnam; and four from the international organizations, CIAT, CABI, AIT and GIZ-ASEAN-BCA project, covering broader aspects relating to potential key pests/diseases of cassava, alien invasive pest management, GIS database support of CM and *A. lopezi* in the GMS, and regulatory harmonization and guidance for application of biocontrol products. The summaries of these presentations are as outlined below with more details and graphics of each presentation given in *Annexes 5-13*.

4.1 Country Reports

4.1.1 Thailand: The presentation of DOAE was delivered by Ms. Watchreeporn Orankanok, Ms. Areepan Upanisakorn and Ms. Phatcharamon Sirilerdwimon. Progress of activities undertaken and the future plans for CM management were described after highlighting cassava as an important national cash crop used for human consumption, animal feed and bioenergy production. In future, the crop will likely become more important when natural energy resources decline further. Presently, the estimated cassava area in Thailand is about 1.23 million ha spread over 49 provinces.

In Thailand, cassava appears to have had no serious pest problem until the CM incursion first occurred in April 2008, with estimated affected area of about 230,796 ha and losses of 200–1,000 million dollars in May 2009. At that time no control measures other than chemical control was applied but this failed to keep CM under control. Biocontrol was initiated with using the local green lacewing (*Pleciochrysa ramburi*). After quarantine host-specificity testing the parasitoid *A. lopezi* (an exotic parasitoid) from Benin by DOA in September) was cleared to be safe for use as a biocontrol agent against CM in Thailand

While under testing in quarantine, efforts were made to educate and to train extension workers on preparation for mass production of the parasitoid. Rearing of CM on pumpkins was developed and used for rearing *A. lopezi*. This has helped to reduce the cost of parasitoid mass production.

For parasitoid field releases, 300 pairs of wasps per hectare were recommended once CM was found in a field. In cases of heavy infestations, releasing 1,250 pairs per hectare was recommended. In July 2010, a release permit was obtained for area-wide releases. Several training courses were organized on mass rearing and releasing of *A. lopezi* to extension officers of DOAE, researchers, and the private sector. MOA arranged a budget to support the parasitoid rearing project with more than 30 parasitoid rearing units established and in operations in DOA and DOAE. In addition, TTDI and other private sector associations also arranged their budgets and facilities for parasitoid rearing and releasing. With such cooperation, more than 6,000,000 pairs of *A. lopezi* were produced and released from July 2010-August 2011 in areas where CM was observed. The CM-infested area of about 176 million ha in May 2009 was quickly reduced to

only 10.88 ha by October 2013, thereby bringing CM under control after releasing large numbers of *A. lopezi* parasitoids.

Regarding mechanisms for pest management at community level, DOAE has established the Community Pest Management Centers (CPMCs) since 2008. The main objectives of the CPMCs are (i) transfer to farmers the knowledge and technical know-how required for self- pest management, (ii) support farmers to control their major crop pests by themselves, and (iii) supervise farmers on rearing natural enemies and microorganisms used for biocontrol. During 2011-2012, there were 882 CPMCs spread over every district throughout Thailand. These acted as representatives of DOAE with each operated by a committee comprising at least 30 members. The primary responsibilities of the CPMCs included (i) monitoring of pests, natural enemies and the environmental conditions through collecting weekly data and analyzing them for pest forecasting, (ii) reporting on pest situations to officers of DOAE, (iii) conducting FFS for farmers to learn the concept/practices of IPM, and (iv) producing biocontrol agents (e.g. *Asecodes hispinarum, Amblysieus longispinosus, Bacillus thuringiensis*, *Beauveria bassiasna, Bracon hebetor, Trichogramma spp*., etc.), whichever species being produced depending on the pest situation in a particular location

IPM plays an important role in CM control in Thailand and has been applied since 2008 until CM was brought under control. The IPM strategy included (i) cultural practices involving plowing and drying the soil for at least 2 weeks in infested field before planting, (ii) chemical control through soaking stalk cuttings in insecticide solution before planting, (iii) biocontrol with releasing *A lopezi* parasitoids and predatory *P. ramburi* lacewings, (iv) mechanical control by cutting infested/damaged shoots and burning them, and (v) other measures such as instructing farmers not to transport infested stalks to avoid spreading the CM to other areas.

Through FFS, farmers learned the IPM strategy and applying it to successfully manage the CM. Also, farmers were convinced to establish CPMC as the smallest pest control unit in a location to help one another. Now, after some years since adopting the pest management approach, results nationwide have shown that crop losses due to pests, in particular CM, have declined drastically. And the success achieved noted to be sustainable and able to secure food security in Thailand's agricultural system, hence enabling Thailand to continue as an important leading export country of agricultural products.

For more detailed information, see *Annex 5*.

4.1.2 Cambodia: In her presentation, Ms. Srun Khema recounted that CM was first found infesting 95 ha of cassava in Pailin in 2009. In 2010, more were found, 5,040 ha infested in Battambang (BTB) and 8,382 ha in Banteay Meanchey (BM). Since 2011, CM was found in many more provinces such as Svay Rieng, Kampong Cham, Ratanakiri, and Kratie. However, they appeared unnoticeable when heavy rain occurred. Concerning the parasitoid *A. lopezi*, only few have been found from a survey of 15 fields carried out in BTB, Pailin and BM. Since there was no introduction done then, the parasitoids most probably have spread naturally across the border from Thailand. Its level of occurrence was primarily governed by the extent of CM infestations, spraying by farmers of chemical pesticides (e.g. andrin, cypermethrin, chlopyrifos and other organophosphorus insecticides), as well as cutting and removal of young shoots/leaves or infested plants.

Pertaining to training of field staff (IPM trainers, technicians, extension workers, others), a 10-day mini-TOT on CM was carried out in BM Provincial Department of Agriculture (PDOA) for 18 people to enable them to train farmers on CM in FFS. The main activities included CM

management, *A. lopezi* rearing, cassava production, pesticide health study, facilitating skill, and methods on how to conduct FFS on CM management. In 2012, a stakeholder meeting was organized there for 29 participants (including 6 women) to discuss and to inform them of the correct procedures for importing/exporting cassava planting materials so as to avoid CM spread. Also the same year, subject-matter training was conducted at PDOA Pailin province for 25 participants (including 5 women). This training was to review/share the country CM situation, including developing work plans to import, rear, release, monitor, and to make impact assessment of *A. lopezi* relating to CM control. It was also to refresh/update the IPM facilitators. Following this and with support from FAO, Mr. Tiva Sampet of DOAE (Chonburi, Thailand) conducted an in-country training on *A. lopezi* mass rearing and releasing for 11 PMU staff (including 4 women) at the Pailin PDOAE.

Activities undertaken on farmer training were 9 FFS involving 276 farmers (including 98 women) in three provinces of BTB, Pailin and BM, six post-FFS involving 115 farmers (including 55 women) in the same provinces, a farmer congress jointly organized by IPM trainers involving 75 farmers (including 32 women) in BM province, and two farmer field days conducted by IPM trainers in BTB and Pailin provinces involving 223 participants (including 115 women).

Concerning preventive measures, these included instituting quarantine measures wherein farmers need to request sanitary import permit letter for export/import of cassava planting materials or natural enemies from the Department of Plant Protection Sanitary and Phytosanitary (DPPSPS), as well as setting up surveillance to systematically check for CM presence/absence, wherein the village leader or commune council have to report to PDOA when CM outbreak occurs.

On mass rearing of *A. lopezi*, staff members of DPPSPS have begun production since June 2013 with 800 pairs produced and planned for release in November 2013.

Some suggestions proposed are for FAO to continue providing support of (i) more training of farmers through FFS, and (ii) maintenance of facilities and technical staff to further undertake mass rearing of parasitoids for releases in fields of farmers.

For more detailed information, see *Annex 6*.

4.1.3 China: In her presentation, Ms. Guo Rong, informed that China is a major cassava production nation with 387,400 ha planted area, 7.93 million ton root production, and average root yield of 20.55 ton/ha (2008). Over 80% of cassava cultivation areas are in sub-tropical region inclusive of the provinces of Guangxi, Yunnan, Hainan, Guangdong, Fujian and Taiwan. The major cassava arthropod pests are spider mite (*Tetranychus cinnabarinus, T. Urticae, Mononychellus mcgregori*), longicorn beetles (*Dorysthenes granulosus*), black cutworm (*Agrotis ypsilon*), chafers (*Anomala corpulenta*), whitefly (*Bemisis tabaci-B, Aleurodicus disperses*), cotton ballworm (*Heliothis armigera*), cotton leafworm (*Spodoptera litura*), mealybugs (*Phenacoccus madeirensis, P. Jackbeardleyi*). CM however has yet to be reported. The main diseases infecting cassava are bacterial blight (*Xanthomonas axonopodis pv*.), brown angular leaf spot (*Passalora henningsii*), root rot (*Phytophthora drechsleri* and *Diplodia manihotis*) and virus transmitted by whitefly.

Since project inception and warning given of potential CM incursions throughout the GMS, the following actions were undertaken to prevent CM entry or its early detection for timely control measures:

- Systematic survey for CM in every cassava growing counties in the provinces of Guangxi, Yunnan and Hainan, especially those near or next to countries with CM. So far, the survey has confirmed that CM is still absent in China.

- Meeting to estimate invasion risk of CM held by the Ministry of Agriculture (MOA) in Beijing in Nov. 2010, wherein researchers from Zoology Institute of Chinese Academy of Sciences and Beijing Forestry University carried out research/analysis of the potential risk from import of cassava planting materials and the various routes involved.
- Joint announcement (No. 1600) issued on June 20, 2011 by MOA and State General Administration for Quality Supervision, Inspection and Quarantine to add CM in the list of quarantine pests of China.
- Conducted four awareness meetings/workshops with training on CM identification and management in Guangxi and Yunnan to advise/remind administration bureaus and extension agencies at county-level to be alert and to conduct regular field observation.
- Poster on major cassava pests/diseases and their management, including CM morphology and the nature of crop damage, its natural enemies, manner of spread, and the preventive and IPM measures. Poster produced in 2013 for distribution to extension workers and farmers in provincial/county levels.
- A scientist/specialist sent to Thailand for training on *A. lopezi* mass rearing, releases and evaluation in preparation for *A. lopezi* introduction should CM were to invade China.
- Consultative seminar held in Guangxi in 2011 by the Plant Protection Station and Institute of Plant Protection of Guangxi Academy of Agriculture Sciences to analyze risk of CM incursion and preparation for application of government funding support pertaining to CM prevention.
- TOT conducted in Hepu County, Guangxi Province in 2012 to train 30 participants from Guangxi and Yunnan provinces by six local facilitators and two Thai experts. The course focused on identification and biocontrol of CM, general cassava pest management and good production practices, including pesticide risk reduction (PRR).
- Following the TOT, a stakeholder meeting was held with 12 local bureau and large-scale cassava growers to create awareness on the potential risk from CM incursion.
- Together with the TOT, five FFS on IPM/PRR-cassava pest management were conducted involving 100 farmers in Hepu, Guangxi, to enhance capacity in cassava pest management. Six more FFS were conducted after the TOT and these involved 150 cassava farmers.

Suggestions made are: (i) regular surveillance for early detection of CM presence and training on identification of CM and other major pests, including IPM, in every concerned province, (ii) enhance phytosanitary measures to prevent CM incursion, and (iii) FAO and relevant international organizations to continue funding regional cooperative activities between countries, such as information sharing, exchange visit, biocontrol technologies, participatory training, mass rearing, releasing and evaluation of parasitoids, etc.

For more detailed information, see *Annex 7*.

4.1.4 Laos: Mr. Phoukaothong Sikaisone in his presentation stated that cassava is grown mainly in the central, north and south-eastern part of the country, in particular Vientiane Capital, Vientiane province, Luangpabang, Xiengkouang, Luangnamtha, Oudomxay, Bolikhamxay, Savannakhet and Champasak Provinces. Varieties grown are largely imported from Thailand and Vietnam. In Laos, cassava production area has increased rapidly, doubling from 16,000 ha in 2010 to 30,000 ha in 2011 and continued to increase to 41,380 ha in 2012. In July-August 2011 a baseline survey by Plant Protection Center (PPC) in Vientiane Capital and the provinces of Bolikhamxay, Salavan, Savannakhet and Champasack revealed about 200 ha of 2-4 month old cassava crop to be severely infested by CM. Crops in Saithany District of Vientiane Capital, Saiphouthong and Songkhon District of Savannakhet province, Lakhonpheng and Laongarm

District of Salavan province, as well as Sanasomboun and Bachieng District of Champasack province, however, had only low to moderate CM infestations.

On confirmation of CM presence, FAO through the TCP Project assisted the Lao Government to implement a number of measures to prevent further spread and to manage the CM. These included the following.

Enhancing quarantine measures, wherein a Notice on Control of CM was issued by PPC on 13.12.2011 and 29.5.2012 to Provincial Agriculture Section and DAFO staff in all provinces country-wide. The Department of Agriculture (DOA) provided technical advice on CM control to Agriculture Section, border checkpoints and other concerned departments in all provinces nationwide. Order to increase monitoring, prevention and control of CM was issued by the Ministry of Agriculture and Forestry in 2011 to all Ministries, Head of Provincial Agriculture Section and Head of all border check points country-wide.

To raise CM awareness, an article on the status of CM infestations and management options in Lao language was published in Vientiane Times Newspapers on 6.9.2011. Also, information brochure was prepared for printing by FAO-IPM Programme in November 2013.

On training of people, PPC staff members were first trained in Thailand (in DOAE Chonburi and TTDI, Nakhon Ratchasima) on mass rearing of *A. lopezi* parasitoid and training curriculum development. They subsequently trained ten other PPC staff and interns at PPC on preparation for parasitoid mass rearing. In late 2011, talks and presentations on CM and its management options including biocontrol were given by PPC staff twice in Champasack and Salavan Province to plant protection and extension workers as well as cassava businessmen. Also, hands-on training on CM survey and identification was given to staff and students of Nabong Agriculture College in 2012. Other training included technical assistance and hands-on training on how to conduct baseline survey, particularly to Indochina Cassava Factory and District Trainers in Pakgnum, Xaythany and Agriculture Section.

A surveillance system was instituted to systematically check for CM presence/absence in different cassava growing areas in the country. In some selected areas, the survey was conducted by PPC staff themselves.

After CM was confirmed present in Laos, immediate actions were taken to introduce *A. lopezi* parasitoid. In the first introduction, 1,000 pairs were imported from Thailand, with 200 pairs retained in PPC for rearing and 800 pairs released in the fields in four locations of two villages of Pakngum and Saithany districts in Vientiane Capital. In the second importation of 1,000 pairs; all were retained for rearing at PPC.

On *A. lopezi* occurrence and its impact on CM and crop damage, including that of other control measures undertaken, it was confirmed the parasitoids are currently well established and have kept spreading out to many cassava fields without releases, e.g. recently in September, it was recovered in Naleuth FFS in Pakgnum and in late October 2013 in Phoudaojengyai FFS in Lakhonpeng district of Salavan province and in Xebangfai District of Khammuan Province (where CM survey was not earlier conducted). The parasitoids can now be readily found in increasing number of areas and observed to provide significant control of CM along with other management measures. Although CM is still a problem in Laos, it is now generally less so in some areas, mainly because of parasitoid releases and their firmed establishment plus favourable good weather conditions (sometimes heavy rainfall).

Parasitoids are still being mass-reared in PPC since late 2011. Large numbers have been reared with about 7,200 pairs released from December 2011 to October 2013 (6,500 pairs in Vientiane Capital, 100 pairs each in Salavan and Bolikhamxay, and 500 pairs in Champasack Province). In each released site, there were four times of monitoring carried out.

TOT and subject-matter training workshop have also been conducted in 2011, involving 50 people including technical staff of PPC, DAFO staff from Vientiane Capital, Bolikhamsay, Savannakhet, Salavan and Champasack Province. On farmer training, five FFS have been organized in five districts and four provinces, involving 147 farmers who will graduate in December 2013. A farmer congress has also been scheduled for December 2013.

On issues of concern, presently there are still few skilled trainers in Laos, hence a relatively lower FFS quality. There is need for all trainers including outstanding graduate farmers (2 from each FFS) to be brought together for a FFS refresher and evaluation workshop in December 2013. Efforts should also be made to ensure training materials are prepared in a timely manner for use by field trainers. Since CM still poses a threat to cassava production, PPC should continue rearing *A. lopezi* parasitoid and the green lacewing for continued field releases in new infested areas.

For more detailed information, see *Annex 8*.

4.1.5 Vietnam: Mr. Ngo Tien Dung in his delivery informed that cassava in the North (Hoa Binh, Nghe An, Phu Tho and Son La provinces) is generally planted as monoculture in ridges (on slopes) and poor soils lacking in nutrients. In Southern Central Coastal Region and Southern Region (Binh Thuan, Ninh Thuan, Tay Ninh, Gia Lai, Kon Tum, Dac Lac and Dong Nai provinces) cassava is grown in flat areas and generally as an intercrop with a number of crops (e.g. maize, rice, groundnut, black bean, mungbean, cashew nut, fruit trees or vegetables). Cassava area may be as high as 70–90% of the total planted area.

The time of planting is dependent on local climatic conditions and the cropping patterns**.** In the North, only one crop is cultivated per year, usually from February to March when soil moisture increases due to spring rains. In South Central Coastal Region, planting usually starts in January and two crops usually grown, with the main season (70% in area) starting in April-May and harvesting from January-March of the following year. The minor crop (30% in area) begins in mid-August to September and lasting until next mid-September to October.

In Vietnam, the cassava area, yield and production has been increasing steadily every year since 2001 and is likely to continue so. The total area has almost double while total production increasing by about three folds. In general, the yield is usually much higher in the north central and central coastal areas, central highlands, and the south east.

CM was first confirmed present in May 2012 in Tay Ninh province (168.7 ha) and causing about 30-70% yield loss of cassava tubers. Subsequently, more were found elsewhere in 2012-2013, namely Quang Tri, Thanh Hoa, Nghe An, Gia Lai, Dong Nai and Son La. However, in the case of Thanh Hoa and Son La, they were found only on cassava cuttings brought from Tay Ninh. Over this period, CM in Tay Ninh has spread further and infesting about 1.142,6 ha.

Because CM poses high risk to cassava production in Vietnam, the Minister of Agriculture and Rural Development on 3 July 2012 issued a Ministerial Order Number 10/CD-BNN-BVTV to implement with urgency the eradication of CM on cassava in Tay Ninh province. On 13 July 2012, the Plant Protection Department released the Guidelines for elimination of CM in Tay Ninh

and requested all cassava production provinces in the country to conduct surveys for CM presence. Also, under the TCP Project, FAO assisted PPD-MARD in organizing a training workshop on CM identification and management from 16-17 August 2012.

In April 2013, PPD-MARD requested FAO for assistance to import *A. lopezi* parasitoid, wherein 1,000 pairs were obtained from Thailand and released in Tay Ninh on 29-31 May 2013 as part of the TOT on mass rearing and field releases of *A. lopezi*. Since then, more activities have been undertaken, namely (i) Mini-TOT on IPM of cassava with special focus on CM held on 8-12 October 2013, (ii) organizing subject-matter training workshop involving 30 technical staff of nine provinces from southern and central Vietnam, and (iii) establishment of rearing facility for mass production of CM and *A. lopezi* parasitoid in Tay Ninh province with the aim to release as many parasitoids as possible in CM-infested fields. Two FFS on IPM of cassava with focus on CM have been planned and will commence in November 2013.

To raise awareness of CM, various publicity media were utilized, such as posters (100 copies), pamphlets/booklets (5,000 copies), newspapers, television (10 times), radio (10 times) and talks/seminars (15 times).

On follow-up actions, these are proposed (i) survey for establishment of *A. lopezi* and evaluate its long term effectiveness, (ii) mass rearing and releasing *A. lopezi* in different ecological zones, (iii) enhance CM detection by citizen key farmers and together organize community action on sustainable management of CM, (iv) exploring cassava varieties with resistance, and (v) investigate other important pest/disease problem, especially Witch's Broom.

For more detailed information, see *Annex 9*.

4.2 International Research and Development Organizations

4.2.1 International Center for Tropical Agriculture (CIAT). In reviewing the opportunities for cassava pest management in the SE Asia region, Mr. Kris A.G. Wyckhuys highlighted that over the past decade the cassava sector in SE Asia has steadily come under pressure through a coincidence of pest invasions, deficient quarantine tactics and far-reaching intensification of cassava agro-ecosystems. While Asian cassava has long remained free of major pest and disease problems, this situation now has abruptly and dramatically changed. In 2008, one of the most destructive pests of cassava, *P. manihoti* (Hemiptera: Pseudoccidae), was reported in Thailand. In little time, *P. manihoti* had substantial impact on local cassava production and readily spread to neighboring Cambodia, Vietnam, Laos and Indonesia. In the meantime, other (polyphagous) invasive mealybugs such as *Paracoccus marginatus*, *Phenacoccus madeirensis* and *Ferrisia virgata*, are being increasingly reported from commercial cassava crops throughout the SE Asia region.

Through a well-orchestrated initiative in late 2009, the parasitic wasp *A. lopezi* (Hymenoptera: Encyrtidae) was brought from West Africa into Thailand for *P. manihoti* control. Although initial results are promising, follow-up research is needed to carefully document *A. lopezi* spread and performance in cassava crops under a broad range of (climatic, biophysical) settings. Also, ecological research waits to be conducted to assess eventual interference with or facilitation by local biodiversity. In the meantime, assays are being conducted to define truly compatible IPM technologies (e.g. stake treatments, sanitation measures), thus assuring that the full potential of biocontrol is used. Lastly, tactics should be developed to boost efficacy and abundance of this wasp, particularly in biodiversity-poor cassava monocultures.

For other invasive mealybugs, such as *P. marginatus*, fortuitously-introduced parasitoids such as *Acerophagus papayae* appear to provide certain level of control. Nevertheless, focused research is needed to carefully assess the potential of (importation) biocontrol of each of these pests and investigate which, if any, natural enemies should be introduced. For some invasive mealybugs, endemic natural enemies could very well provide sufficient pest control, but essential food, host or shelter opportunities may be lacking in simplified cassava crop ecosystems.

In countries where *P. manihoti* is not yet reported, such as India, China and the Philippines, research is urgently needed to build resilience of cassava cropping systems. Work from other crops shows that on-farm biodiversity could be wielded to turn local cassava crops far less susceptible to colonization by invasives. Habitat manipulation can boost the abundance and efficacy of generalist predators and parasitoids, and several other tactics wait to be assessed to keep cassava crops, regions and countries free of some of these destructive pests.

In conclusion, invasive mealybugs have come to severely impact SE Asia's cassava production and collaborative research is needed to secure the long-term sustainability and profitability of this important crop. Without doubt, an in-depth assessment and meticulous manipulation of on-farm biodiversity will play a central role in tackling several of these invasive pests.

For more detailed information, see *Annex 10*.

4.2.2 CAB International (CABI). In sharing the experiences on invasive insect species management and the relevance to cassava mealybug, Mr. Annamalai Sivapragasam pointed out that the introduction of invasive insect species into a country can be through a number of pathways - long distance migrations or movements via transportation and human activities. With increased international travel, daily movement and incidences of exotic species have certainly increased in both frequency and its complexity. Despite the numerous environmental sieves and dispersal constraints, natural disasters and human interventions that influence the outcome, successful introduction, colonization and subsequent naturalization of an invasive species in a new habitat does happen as we see from numerous examples worldwide. Nevertheless, the rates are, fortunately, incredibly low. Experiences with the management of some key invasive pests are highlighted based on the author's experiences and those of others. Lessons learnt could provide better impetus towards formulating appropriate strategies against the CM which is the primary target of the TCP Project.

There are specific challenges concerning management at the various stages along the invasive insect species pathway followed by the nexus of strategies that could be used, such as whether to invoke quarantine regulatory measures amidst the concomitant socio-economic ramifications. If the introductions of exotic natural enemies are to be considered as an option, then there are specific challenges, such as correct identification of the species and its area(s) of origin, selection of the right agent(s); mass rearing and associated issues relating to quality control and sex ratio shifts, release techniques and evaluation of impact based on limited releases and subsequent mass releases of the agent(s). It should also be noted that the key to success of introductions lies not so much in ecological or economic constraints, but in the institutionalizing of biocontrol as a primary option in the context of IPM. Farmer involvement is also the key to mitigate conflicts and maximize adoption and diffusion.

For more detailed information, see *Annex 11*.

4.2.3 Asian Institute of Technology (AIT). This presentation by Mr. Prabhat Kumar described the Geographical Information Systems (GIS) to provide spatiotemporal analysis of spread of CM and its parasitoid *A. lopezi* in the GMS. The work was undertaken since 2011 by AIT in collaboration with GMS partner countries of the TCP Project with the primary aim to understand CM distribution and its risk to cassava cultivation.

A quality GIS database was set up to monitor and document where cassava is cultivated, the areas infested by CM and level of damage, plus where *A. lopezi* has become established. The tasks involved data collection, processing and integration into GIS database for mapping purposes.

Two sets of data collection and mapping were performed, i.e. 2011 (for data of 2010-2011) and 2013 (for data of 2011-2012/2013), with maps generated at province/district level using SAVGIS. For each country, factors contributing to CM incidence, infestation severity, etc., were first mapped individually. Subsequently the composite risk maps were generated by combining all the contributing factors. Analytical Hierarchy Process was used to perform multi criteria decision analysis. Seven criteria were considered, namely cassava cultivated area, CM status (presence/absence), rate of infestation, *A. lopezi* status (presence/absence), area of parasitoid release, rate of parasitization, and % area reported with parasitoid to total cassava cultivated area. From these, the spatial risk maps of the countries were produced by bringing the final score of the seven criteria into GIS platform.

By comparing the results of spatiotemporal analysis risk maps for CM incidence and spread trend for the two different time periods (2010-2011 and 2011-2012/13), it may be concluded that both Cambodia and Laos exhibited more or less constant risk in both the periods of 2010-2011 and 2011-2012, whereas Vietnam exhibited additional CM occurrences and thus more potential risk during 2012-2013. China, however, was free of CM during both the study time periods.

From this study, GIS has provided spatiotemporal analysis of the occurrence of CM and its parasitoid *A. lopezi* in the GMS partner countries. It has helped in understanding their incidence, spread and the resultant effects of these on cassava growing. However, to have a more in-depth analysis, there is need to have more extensive data collection taken not only more frequently but also at sub-district level.

For more detailed information, see *Annex 12*.

4.2.4 GIZ-ASEAN-BCA project: In presenting the topic of ASEAN biocontrol for sustainable agrifood systems: regulatory harmonization and guidance for application of biocontrol products in Southeast Asia, Mr. Thomas Jäkel first clarified that the ASEAN biocontrol for sustainable agrifood systems (ABC) is a regional cooperation project between the ASEAN Secretariat and German International Cooperation (GIZ) commissioned by the German government. The project supports the ASEAN Secretariat in its efforts to address food security as a major thrust in ASEAN's agenda for the roadmap to the ASEAN community (2009-2015). The objectives of ABC not only address food security but also contribute to other issues highlighted by ASEAN, including improvement of the IPM approach, sustainable food trade development, reducing use of synthetic pesticides and production of safe food, and the positioning of crop protection in view of climate change.

ABC's major goal for the first phase (2011-2013) was to develop guidelines for the regulation, trade, and use of biological plant protection products, which should be agreed upon among ASEAN Member States (AMS). By November 2013 most of the contents had been drafted and

discussed among AMS. The document will be submitted for endorsement via the ASEAN Sectorial Working Group on Crops to the ASEAN Ministers of Agriculture and Forestry in 2014.

To engage AMS in the discussion and work process for the Guidelines two so-called 'regional expert groups' were formed, which included representatives of regulatory and other expert divisions of the departments of agriculture. One group focused on 'regulation' including trade, the other on 'application' issues.

The regional experts on regulation (nine AMS) discussed and concluded on ways of how to harmonize data requirements and to simplify the regulatory process for biocontrol products. Major results of the work included minimum data requirements for microbials and botanicals, regulatory guidance and reference for macrobials (macro-organisms) and semiochemicals, draft field testing protocols for microbials and botanicals, recommendations for testing semiochemcials, and guidance on trade of biocontrol products (in collaboration with the Expert Working Group on Harmonization of Phytosanitary Measures in ASEAN.

The regional expert group on application (nine AMS) identified three major crops and the associated pests and diseases, for which guidance on the application and use of biocontrol products was developed. These included rice, where the use of entomopathogenic fungi against brown plant hopper, pheromone-based mass trapping for stem borer management, and biocontrol using fungi against rice blast disease were suggested. In vegetables, release and application of *Diadegma* spp. and *Bacillus thuringiensis*-products, respectively, were proposed for diamondback moth control. Bacterial and fungal biocontrol agents (*B. subtilis*, *Trichoderma* spp., *Streptomyces lydicus*) were considered useful against *Fusarium*-infections. For area-wide management of fruit fly AMS recommended the application of protein bait and male mass-trapping with attractants.

The work of both groups was supported by the Project's database on biocontrol products, which was developed on the basis of all registered products in AMS and annotated with relevant market information. For instance, the database not only provided for monitoring of registrations but also can create target and source profiles specific for AMS.

For more detailed information, see *Annex 13*.

5. Study Visit to Tay Ninh

As part of the Final Meeting, a study visit was made to Tay Ninh province where CM incursion first occurred in Vietnam in May 2012. The purpose was to better understand the local situation of the CM problem so that participants can offer pertinent suggestions on how best to combat the CM. The activities comprised (i) visit to observe cassava fields and to discuss with extension workers/farmers, (ii) briefing on CM problem in Tay Ninh and the actions taken, and (iii) observe mass rearing of *A. lopezi* parastiods for use in field releases.

5.1 Field visit: In three separate groups, participants visited different cassava fields. In general, CM infestation at time of visit was observed to be very low. Thus, finding *A. lopezi* parastiods in the field also proved difficult because of limited host. Feedback indicated that cassava cultivation in the area may be either grown as monocrop or in rotation with other short term crop. Even as rotational cropping, cassava can most of the time be found because of staggered planting. This has implication of continuous availability of suitable plant host for the CM which in turn may also prove helpful for the parasitoids. Cassava stalks after harvest may be kept aside in the field

for planting of the next crop or sold to other farmers. Since these are usually not protected with chemical insecticides they thus serve as sources of CM infestations and contribute to its spread.

5.2 Briefing: Mr. Ho Van Chien, Director, Southern Regional Crop Protection Center, in presenting the CM situation and its management in Tây Ninh province, first informed participants of the cultivation scenario in Tay Ninh, explaining that cassava is one of the main crops in the province and grown in nine districts with a total area of about 45,000 ha, average yield of 30 tons/ha, with maximum up to 80 tons/ha. The production is mainly to service the industrial factories. Usually, the cultivating practice is monocropping in the upland and intercropping with rubber and rotation in rice land.

When CM incursion was first confirmed in Tay Ninh, MARD immediately notified the provincial people committee the importance of this exotic pest with description of its distinctive features and nature of spread and officially ordered (Telegram No. 10/CD-BNN-BVTV, dated 3 July, 2012) for destruction of all CM sources in Tay Ninh province. Also, in hope to prevent its possible spread to other provinces, wide-scale surveillance for its occurrence was instituted with all efforts by technical staff devoted to guide farmers on crop destruction with monetary compensation given to them.

For PPD, other crucial tasks included training and guiding staff of Tay Ninh PPSD on proper methods of crop destruction and disposal, including the types of chemical insecticides which could be used (e.g. Thiamethoxam, Imidacloprid, Nitenpyram, Dinotefuran) and how to use them to help prevent CM spread. Also, for other provinces, farmer training were conducted on crop monitoring procedures for detection of CM to enable timely action on its control where necessary. Nationwide, quarantine effort was intensified to intercept and prevent spread through movements of potential CM-contaminated carriers, in particular forbidding the transportation of cassava rootstocks and fresh-roots from infested areas to other places. In spite of such measures, there were instances where interception proved inadequate because of some areas being quite remote.

In April 2013, with assistance from FAO, PPD-MARD imported 1,000 pairs of *A. lopezi* parasitoids from Thailand for release in Tay Ninh (on 29-31 May 2013) as part of the TOT on mass rearing and field releases of *A. lopezi*. More activities have since been undertaken, such as TOT on IPM of cassava focusing on CM, establishing rearing facility for mass production of *A. lopezi* parasitoid in Tay Ninh province for releases in CM-infested fields, conducting two FFS on IPM of cassava with focus on CM, and raising awareness of CM through various publicity media such as posters (100 copies), pamphlets/booklets (5,000 copies), newspapers, television (10 times), radio (10 times) and talks/seminars (15 times).

In general, during dry season when rainfall can be less than 30 mm, CM infestations are particularly severe. However, it is encouraging to note that since July 2013 the CM population is very low, with about 440 ha infested areas showing signs of recovery and 702 ha already harvested with satisfactory yields.

For more detailed information, see *Annex 14*.

5.3 Parasitoid mass rearing. Like the visit to cassava fields, participants in three separate groups visited in turn to three parasitoid rearing units (small net houses, large net house, and rearing laboratory). Participants observed CM rearing on both young cassava plants and pumpkins. Occasional problems encountered were contamination by other kinds of mealybugs and limited

supply of suitable pumpkins in the market. In such situations, production of *A. lopezi* parasitoids may suffer some decline due to limited CM hosts. Nonetheless, both host and parasitoid production have generally progressed well, wherein satisfactory numbers of parasitoids could be harvested for field releases.

The visit to Tay Ninh was not only useful and informative to participants of the Final Meeting but has also proved highly beneficial, fortuitously though, to the local staff undertaking the parasitoid rearing in that they have the opportunity to clarify many issues and obtained deeper understanding from the visiting Thai delegates who possess vast experience of both CM and the parasitoids, in particular Mr. Tiva Sampet who previously had visited to teach and helped them initiated the whole parasitoid mass rearing process.

6. Recommendations on Ways Forward

On the final day, participants formed two Working Groups (1 and 2) to brainstorm on ways forward beyond the TCP Project, viz:

Group 1 for countries where CM is currently absent but facing potential threat of incursion because the CM is already present in some countries in the region, as well as for those with CM but *A. lopezi* parasitoids absent. (For these countries, a regional/international approach and efforts, including possible external assistance, may take priority to deal with the threat).

Group 2 for countries where both CM and *A. lopezi* parasitoids are already present. (For these countries, national efforts usually would take priority, although regional/international contributions are not to be excluded entirely).

Based on the presentations at the Final Meeting and discussions thereof, as well as findings from the visit to Tay Ninh, participants of the Working Groups identified the key issues after appraising the existing CM situation and potential risks. Thereon, the Groups formulated the ways forward for follow-up actions which were then presented and further deliberated in the plenary session. The final outputs, herewith presented as the 'recommendations on ways forward' are as given below.

6.1 Working Group 1.

6.1.1 Appraising current CM situations and potential risks. To make the appraisals the Group first identified the main risk factors, namely (i) climatic suitability for CM, (ii) bordering countries with CM presence, (iii) sourcing of cassava materials from infested areas, and (iv) absence of appropriate biocontrol agents. Considering these criteria and with other influencing factors (e.g. importance of the national cassava sector), the countries with risks are ranked as follows:

- **Indonesia** (1.2 million ha): Climatic suitability, CM confirmed present near Jakarta and spreading; *A. lopezi* parasitoid absent. Risk = High.
- **India** (280,000 ha): Climatic suitability and CM absent. Risk = High.
- **China** (269,000 ha): CM absent, cassava growing areas bordered by other CM-infested countries, risk generally high but importance varies due to within-country differences. Risk = High for Hainan Island and Guangxi province close to Vietnam's infested border. Risk = Moderate for Yunnan province;

- **Philippines** (216,000 ha): Climatic suitability high in some areas and CM absent. Risk = High.
- **Malaysia** (42,000 ha): High climatic suitability, CM absent, bordered by other CM-infested countries. Risk = High.
- **Myanma**r (27,000 ha): Climatic suitability and bordered by other CM-infested countries, no serious pest/disease problems, CM absent. Risk = High.
- **Sri Lanka** (24,000 ha): High climatic suitability, CM absent, source of planting materials mainly from India. Risk = Moderate.
- **Timor-Leste** (9,000 ha): High climatic suitability, CM absent, bordered by CM-infested country. Risk = High.

6.1.2 Key issues/potential problems. Guided by the above appraisals, the following key issues/potential problems requiring actions have been identified.

6.1.2.1 Non-technical issues.

a. Lack of awareness of CM problem by stakeholders in all countries at risk.
b. Lack of regulatory documentation and quarantine guidelines to halt importation of planting materials infested with CM in all countries at risk.
c. Budgetary limitations and low priority setting given to cassava because crop often not considered 'important', hence no time/resource allocation to do comprehensive survey or extension work.

6.1.2.2 Technical issues.

a. Lack of comprehensive survey/surveillance work for cassava crops.
b. Need to identify mealybugs at the species level.
c. Lack of quality data to reflect abundance, impact and importance of mealybugs.
d. Lack of knowledge on the ecology, spread (distribution) and management of potential key pests/diseases.
e. With exception of China, generally no preparedness/knowledge on how to deal with CM, especially in using *A. lopezi* parasitoid.

6.1.3 Recommended actions on ways forward. (The recommendations given below are to address each specific issues/problems identified above based on appraisal of the main risk factors of CM incursion).

6.1.3.1 Non-technical issues.

a. For lack of awareness of CM problem by stakeholders in all countries at risk, the recommended actions to take at national/regional/international level would include:
    - Regional awareness workshop on invasive cassava mealybugs.
    - Disseminate information of CM through regional networks (ASEAN, APPPC, GMS countries).
    - Intensive farmer extension to raise awareness, and introduce proper tactics for CM prevention and management.

b. For Lack of regulatory documentation and quarantine guidelines to halt importation of planting materials infested with CM in all countries at risk, the recommended actions to take would include:
   - Preparation/formulation of proper documents and quarantine procedures.
   - Revisit existing documentation (e.g. FAO manual on safe movement of cassava germplasm).
   - Quarantine officials to take part in workshops relating to cassava mealybugs.
   - Biosecurity plan outlining opportunities and threats for different countries in the region.

c. For budgetary limitations and low priority setting given to cassava because crop often not considered 'important' (hence no time/resource allocation to do comprehensive survey or extension work), the recommended actions would include:
   - Putting CM on the country's agenda, especially for Indonesia, Philippines and India.
   - Quantify economic value of industry and impact to national cassava sector/value chain

6.1.3.2 Technical issues.

a. Lack of comprehensive survey/surveillance work for cassava crops.
b. Need to identify mealybugs at the species level.
c. Lack of quality data to reflect abundance, impact and importance of mealybugs.

Recommended actions taken collectively for a, b, c above would include the following:
   - Conduct survey of mealybugs on cassava.
   - Identification of cassava mealybugs at species level.
   - Design and validate proper monitoring tools and strategies.
   - Train field scouts to undertake surveys.

d. For lack of knowledge on the ecology, spread (distribution) and management of potential key pests/diseases, the recommended action is to:
   - Conduct basic and applied research on cassava pest management at the same time keeping track of progress made in other countries

e. On how to manage CM, the recommended actions would include:
   - Defining fully the compatible IPM/GAP technologies.
   - Obtain training on *A. lopezi* parasitoid rearing methodology and biocontrol in country where these have been achieved successfully.

6.1.3.3 On regional/international efforts or assistance required, the recommended actions would include the following:

a. Organize regional training.
   - To create awareness of CM-spread likelihood and potential detrimental impact.
   - To impart knowledge on applied/technical aspects, in particular how to prevent CM entry and its management when presence detected.

b. Serve as knowledge bank/data sharing.
   - Coordinate country collaborators.
   - Facilitate partnership for information sharing.
   - Source of expertise on biocontrol.

c. Finance pest management/prevention actions.
   - Identify funding sources (e.g. IFAD, ADB, private sector, etc) and formulate project proposals
   - Assist to establish public-private partnerships, including financial support.
   - As driving force for proposal development and obtaining financial support.

d. Inter-country support.
   - Importation of biocontrol agents, e.g. FAO, APPPC, etc., as facilitators.

6.2 Working Group 2.

6.2.1 Appraising the current CM situations. The Group noted that CM has continued to spread within the countries where it is present. This is so even though *A. lopezi*, an effective parasitoid is already present, suggesting more efforts are needed to either conserve or augment the parasitoid populations. Even so, over time more areas would likely become infested unless increased efforts are also made to stop or delay the spread. However, it is noted that the populations of CM in newly-infested areas are generally low even though the overall infested area may be fairly extensive. It is also clear that infestations tend to cluster initially along the national boundaries, suggesting movements of CM across neighboring countries. This again indicates that movements of infested planting materials may be an important factor contributing to the spread.

6.2.2 Key issues/potential problems. Guided by the above appraisals, the Group has identified the following key issues/potential problems still existing and requiring follow-up actions. Most of these however are not applicable in the case of Thailand.

- Farmers and government extension workers in the provinces not supported by the TCP Project still lacking in capacity to identify CM nor have access to *A. lopezi* parasitoids.
- Movements of untreated planting materials are still commonly carried out by farmers and others.
- There is inadequate capacity to enforce sanitary/phytosanitary procedures.
- Farmers continue to spray chemical insecticides/herbicides which can adversely impact *A. lopezi* parasitoids.
- Although there is capacity to rear *A. lopezi* parasitoids within the countries, a key constraint is lack of sufficient facilities to do so on a large scale.
- The cassava private sectors are engaged primarily in their own agenda of only to sell their products and have little concern for the CM problem.

6.2.3 Recommended actions on ways forward. (The recommendations given below are to address each specific issues/problems identified above based primarily on appraisal of CM spread in the infested countries).

6.2.3.1 Educating/training all stakeholders on CM identification.

- Provide short training on how to identify CM to farmers, government extension workers and private sectors which have yet to receive such training.
- Undertake season-long FFS for farmers to learn good agricultural practices for CM spread prevention and management (e.g. correct land preparation, storage and treatment of planting materials, etc.).
- Create wide-scale awareness of CM using Information Education Communication materials.

6.2.3.2 Institute nation-wide field CM monitoring (e.g. as with Community Pest Management Centers in Thailand; Commune Plant Protection Officer for early detection as in Vietnam)

- Enhance/strengthen existing monitoring systems in each country.
- Work closely with the farmers and farm communities to help monitor the CM situation.
- Provide technical backstopping to agriculture agencies to strengthen their capacities in CM monitoring activities.
- Carry out weekly monitoring for CM and in case of serious situations to report immediately to the local agriculture agency for timely follow-up actions.

6.2.3.3 Engaging farmers, (including private sectors) and the relevant government agencies.

- 'Make' farmers feel CM is their problem.
- 'Make' policy makers understand how the CM will impact on the country's economy.

6.2.3.4 Apply IPM measures (through phytosanitary and good agricultural practices).

- Strengthen country's quarantine system, both domestic and international procedures.
- Implement phytosanitary measures before export of planting materials, as required by the importing country
- Implement field sanitation after harvesting the cassava crop.
- Keep planting materials in proper storage.
- Ensure land preparation is in accordance to good agricultural practices.

6.2.3.5 Apply IPM measures (through using biocontrol agents).

- Conserve natural enemies through judicious use of chemical pesticides when necessary.
- Timely release of *A. lopezi* in fields newly infested with CM (hence need to maintain parasitoid stocks, establishment of facilities in 'hot spots', and use of grids to determine parasitoid releases).
- Educate/train extension staff and farmers on *A. lopezi* parasitoid.
- Carry out research to support the biocontrol activities.
- Spray planting materials with insecticides before transporting them.
- Before planting, soak rootstocks with recommended chemical insecticides.
- If herbicides are to be used for weeding in the field, plan the releases of *A. lopezi* such that their impacts on the parasitoids will be minimised.

6.2.3.6 Assistance from national institutions within country.

- Policy support from Government policy-makers.
- Private sector support
- Adequate budget (for training of farmers and extension workers, technology development, and research by institutions/universities).
- Support for mass media information dissemination to raise awareness.
- National IPM Programmes could contact FAORs for assistance to link up with potential donors for follow up to TCP Project activities.

6.2.3.7 Assistance from neighboring countries.

- Study visit to Thailand to learn ongoing and upgraded activities in managing CM.

6.2.3.8 Assistance from regional/international institutions (including donor organizations).

- Networking at regional level for experience sharing and other related activities.
- Financial support for further training in specific aspects relevant to CM management, mass rearing facilities, and CM-associated technology developments.
- Identify organizations/donors for additional support/buy-in into ongoing activities (e.g. CIAT, others).

6.2.3.9 Country specific requirements.

- Cambodia: Facilities for mass rearing, technical assistance on biocontrol, effective methodologies for training farmers.
- Laos: Surveillance system, facilities for mass rearing, technical assistance on biocontrol, effective methodologies for training farmers.
- Thailand: Enhance use of GIS for surveillance, including further strengthening of pest surveillance teams.
- Vietnam: Improving farmer knowledge on CM management, support for farmer training especially in remote and isolated areas, development of key farmers and effective communication system.

7. Closing Remarks

Mr. Jan Ketelaar in his closing remarks expressed thanks to all attending the Final Meeting for their active participation, not only in sharing experiences of their particular expert topics but also their invaluable contributions in helping develop recommendations on the ways forward beyond this TCP Project. He assured participants that their painstaking efforts and well-thought-out recommendations would be given consideration for inclusions in the TCP Terminal Statement. All collaborating Governments would receive the Terminal Statement wherein country-relevant recommendations would receive consideration on their possible implementation.

He next emphasized how Thailand has played a key role in this regional initiative by leading the way and assisting neighboring countries through expertise and technology supported by FAO, in particular in sharing their experience and expertise to help other partner countries attain what they are to date, especially the capacity to mass rear *A. lopezi* parasitoids which are crucial for CM control. Thailand has shown great initiative and dedication to support the objectives of the project, be it within Thailand or the collaborating partner countries. And this is truly an excellent example for South-South Cooperation facilitated by FAO. For this, he expressed a special thanks to Thailand.

Despite limited time, resources and capacities, the project activities have been so successful that it is likely to receive continuing support from the Governments themselves. However, mobilization of donor funding and regional/international agency support would most certainly help expedite the process in enlarging the current success. It is most fortunate that the CIAT regional project on CM has just taken off wherein are also involved the GMS countries. Hence, the timely continuation of dealing with the CM problem could play a key role in taking the management of CM in the region to the next higher level.

Moving on, he reminded the project focal points to round up what's still left to be completed, especially where the allocated budget for them have yet to be utilized. In particular Vietnam, the most recent among others to have CM incursion, has still some urgent activities to fulfill.

Pointing out that despite the FAO TCP Project has only limited budget and time to work through, the success has been immeasurable and the objectives more than achieved. He felt this was due to the hard work and conscientious efforts put in by everyone involved in the project (country collaborators, consultants, FAO staff) and would like, also on behalf of Mr. Piao Yongfan (LTO of the TCP Project, who unfortunately was unable to participate because of another commitment), to offer deep thanks to all for their contributions toward accomplishing this.

In concluding, thanks were expressed to all for their contributions in making the Final Meeting a success, in particular the many staff members of PPD/PPSD/RPPC Vietnam and FAO staff for their superb efforts in organizing the meeting and the resource persons for their invaluable inputs.

Annex 1:
Itinerary and Activities

Date / November	**Overnight location**	**Activities***
4 (Mon)	HCMC	• LTC: Travel Kuala Lumpur–HCMC (air) • TC : Travel Nakhon Rachasima-Bangkok (car) -HCMC (air) • On-site meeting preparation/requirements
5 (Tue)	HCMC	• LTC & TC: Final Meeting in HCMC
6 (Wed)	HCMC	• LTC & TC: Field Visit [Travel HCMC-Tay Ninh-HCMC (car)]
7 (Thur)	HCMC	• LTC & TC: Final Meeting in HCMC
8 (Fri)	Kuala Lumpur (LTC) Bangkok (TC)	• LTC: Travel HCMC -Kuala Lumpur (air) • TC : Travel HCMC-Bangkok (air)
9 (Sat)	Nakhon Rachasima	• TC : Travel Bangkok-Nakhon Rachasima (bus)

*LTC = Lead Technical Consultant
TC = Training Consultant

Annex 2
List of Participants

Final Meeting of the TCP on Capacity Building on Spread Prevention and Management of Pink Cassava Mealybug in the Greater Mekong Subregion (TCP/RAS/3311)
Ho Chi Minh, Vietnam, 5-7 November 2013

Country		Name	Designation/ Organization
Cambodia	1	Mr. So Thavrith	Technical office, Department of Plant Protection Sanitary and Phytosanitary , Phnom Penh **E-mail:** sothavrith@yahoo.com
	2	Ms. Srun Khema	Training IPM Coordinator, FAO IPM Programme **E-mail:** faoipm.natstaff@online.com.kh
China	3	Ms. Guo Rong	TCP National Project Coordinator and Senior Agronomist, Pest Control Division, NATESC, Beijing **E-mail:** guorong@agri.gov.cn
	4	Ms. Zhou Yang	Assistant Agronomist National Agro-technical Extension and Service Center, MOA**,** Beijing **E-mail:** zhouyang@agri.gov.cn
	5	Mr. Xie Yi Ling	Senior Agronomist, Guangxi Provincial Plant Protection Station, Guangxi PPS **E-mail:** xieyiling001@126.com
	6	Ms. Hu Xinmei	National IPM Programme Officer, Kunming **E-mail:** hu.xinmei@gmail.com
Laos	7	Mr. Phoukaothong Sykaisone	TCP National Project Coordinator and Technician, PPC, Vientiane **E-mail:** pkaothongIPM@yahoo.com
	8	Ms.Vornthalom Chanthavong	Programme Assistant , FAO IPM Programme, Vientiane **E-mail:** vornthalom.chanthavong@gmail
Myanmar	9	Ms. Ni Ni Tint	Assistant Research officer, Department of Agricultural Research, Ministry of Agriculture and Irrigation **E-mail:** tint.ni@gmail.com
Thailand	10	Ms.Watchreeporn Orankanok	NPC , Director of Pest Management Division, DoAE, BKK **E-mail:** watchreeporn@yahoo.com
	11	Ms. Areepan Upansiskorn	Head, BioControl Group, Pest Management Div, DoAE **E-mail:** areepan03@yahoo.com
	12	Ms. Phatcharamon Sirilerdwimon	Co-Manager Area-wide Integrated Control of Pink Cassava Mealybug Project, DoAE **E-mail:** kunnai2008@gmail.com
	13	Mr. Tiva Sempetch	Consultant, Chonburi Pest Management Center **E-mail:** pmc03@doae.go.th
Vietnam	14	Mr. Ngo Tien Dung	NPC, Deputy Director and IPM Programme Coordinator, PPD **E-mail:** ipmppd@fpt.vn
	15	Mr. Nguyen Van Hong	Vice Director Tay Ninh PPSD Tay Ninh, **E-mail:** ktbvtvtn2009@gmail.co
	16	Mr. Bui Xuan Phong	Forestry Division PPD-MARD Hanoi, **E-mail:** buixuanphong@gmail.com
	17	Mr. Dang Van Manh	Deputy Director Phu Yen PPSd Phuyen **E-mail:** manh.ipm@gmail.com
	18	Ms. Le Thi Kim Huyen	International Cooperation Department - ICD Hanoi, **E-mail:** huyenlk.htqt@mard.gov.vn
	19	Mr. Tran Van Hieu	Programme Assistant FAO IPM Hanoi **E-mail:** Hieu.Tranvan@fao.org
	20	Mr. Ho Van Chien	Director, Southern RPPC PPD-MARD Tien Giang, **E-mail:** hvchien@vnn.vn
	21	Mr. Nguyen Huy Trung	Driver, FAO IPM Hanoi
Representatives from Regional	22	Mr. Kris Wyckhuys	Regional Research Leader , CIAT, Hanoi, Vietnam **E-mail:** k.wyckhuys@cgiar.org
	23	Mr. Prabhat Kumar	Senior Researcher, AIT, Pathum Thani **E-mail:** pkipm@ait.ac.th
	24	Mr. A. Sivapragasam	Senior, Entomologist, CABI SE & East Asia, KL

Organizations			**E-mail:** a.siva@cabi.org
	25	Mr. Thomas Jaekel	CIM Expert on Biological Plant Protection, ASEAN-GIZ-BCA Project, Bangkok, **E-mail:** thomas.jaekel@cimonline.de
	26	Mr. Jan W. Ketelaar	CTA, IPM Programme **E-mail:** Johannes.Ketelaar@fao.org
	27	Ms. Alma Linda Abubakar	Programme Officer, IPM Programme **E-mail:** Almalinda.Abubakar@fao.org
	28	Mr. Uwe Voortman	Programme Officer, FAO RAP **E-mail:** Uwe.Voortman@fao.org
	29	Mr. Lim Guan Soon	Lead Technical Consultant **E-mail:** cosmic-unity@psynex.net
	30	Ms.Tattanakorn Moekchantuk	Training Consultant **E-mail:** tattanakorn@gmail.com
	31	Mr. Kornchort Anansirikamol	Information Technology Assistant, FAO RAP, BKK **E-mail:** kornchort@gmail.com

Annex 3
Programme of Final Meeting

Final Meeting of the TCP on Capacity Building on Spread Prevention and Management of Pink Cassava Mealybug in the Greater Mekong Subregion (TCP/RAS/3311)
Ho Chi Minh, Vietnam, 5-7 November 2013

4 November: Monday		
Time	**Activity**	**Notes/ Facilitators/ Chairpersons**
AM/PM	• Arrival in HCMC Vietnam • Que Huong Liberty 4 Hotel, 265 Pham Ngu Lao Street District 1, Ho Chi Minh City, Vietnam Telephone: (84-8)3836 4556; Fax: (84-8) 3836 5435 Email: liberty4@libertyhotels.com.vn	Transport Airport to Hotel. On arrival, look for person holding FAO sign for airport pick-up arrangement. US $1 = 21,000 Dong
5 November: Tuesday		
08.00	• Registration	All participants (Tattanakorn Moekchantuk / Tran Van Hieu)
08.50	• Participants to be seated	All participants
	Opening Session	***Emcee:*** Alma Linda Abubakar
09.00	• Welcome and Opening Remarks	Ngo Tien Dung, Deputy Director General, PPD-MARD Vietnam
09.10	• TCP Final Meeting: Objectives and Meeting Programme	JW Ketelaar, CTA-FAO Regional IPM/PRR Programme
09.25	• FAO TCP Project on cassava mealybug: Background and progress overview	GS Lim, LTC FAO
09.55	• Group Photo	All participants
10.00	• Tea/Coffee Break	
	Technical Session I: **Thailand's Achievements in Cassava Mealybug (CM) Management**	***Chairperson:*** *Ngo Tien Dung, Deputy Director General, PPD-MARD Vietnam*
10.30	• Experience/achievements of CM management of DoAE in Thailand.	Watchareeporn Orankanok, Areepan Upanisakorn, Patcharamon Sirilerdwimon DoAE
11.00	• Plenary discussions	
	Technical Session II: **TCP Project Achievements/Impacts & Way Forward in GMS Countries**	***Chairperson:*** *Uwe Voortman, Programme Officer*
11.30	• Country report: Cambodia	Srun Khema, Cambodia
12.00	• Lunch Break	
13.15	• Country report: China PR	Guo Rong, China

13.40	• Country report: Lao PDR	Phoukaothong Sykaisone. Laos
14.00	• Country report: Vietnam	Ngo Tien Dung, Vietnam
14.20	• Plenary discussions	
	Technical Session III: **International R&D and Other Supporting Institutions**	***Chairperson:*** *Watchareeporn Orankanok, Director of Pest Management Division, DoAE*
14.40	• Opportunities for cassava pest management in the SE Asia region: An overview	Kris Wyckhuys, CIAT
15.10	• Tea/Coffee Break	
15.30	• Experience in invasive insect species management and the relevance to cassava mealybug	A. Sivapragasam, CABI
16.00	• Geographical Information Systems to provide spatiotemporal analysis of spread of cassava pink mealybug and its parasitoid *Anagyrus lopezi* in the Greater Mekong Subregion	Prabhat Kumar, AIT
16.25	• ASEAN biocontrol for sustainable agrifood systems: Regulatory harmonization and guidance for application of biocontrol products in Southeast Asia	Thomas Jäkel, GIZ-ASEAN-BCA project
17.00	• Plenary discussions	
17.30	• End of Technical Session III	**Note**: Participants to be in lobby by 18.45 hr (time transport leaving for Vietnam House)
19.00	Welcome Dinner at Vietnam House (Hosted by the Government of Vietnam)	Welcome Remarks, Ngo Tien Dung, Deputy Director General, PPD-MARD *Emcee:* Tattanakorn Moekchantuk
6 November: Wednesday		
07.00	***Visit to Field/Lab in Tay Ninh*** • Mealybug infested cassava fields with/without parasitoid releases • Rearing of *Anagyrus lopezi* parasitoid • Lunch on route	Alma Linda Abubakar /Tran Van Hieu/Ho Van Chien/Dang Van Manh
7 November: Thursday		
	Technical Session IV: **Working Groups: The Way Forward**	***Briefing:*** *GS Lim*
08.00	• Working Groups and the tasks	GS Lim
08.30	• Participants break up into 2 Working Groups (1 & 2) to work as follows: **Working Group 1**. To brainstorm and develop ways forward for countries where CM is currently absent but facing potential threat of incursion because the CM is already present in some countries in the region. Also for countries with CM but *A. lopezi* parasitoids absent. (For these countries, a regional/international approach and efforts, including possible external assistance, may take priority to deal with the threat).	**Chairperson:** Mr. A. Sivapragasam **Rapporteur:** Mr. Kris Wyckhuys [Group members: China, Indonesia, Myanmar, Thailand (selected participants), AIT, CABI, CIAT, FAO, and others who choose to join in to assist]
	Working Group 2. To brainstorm and develop ways forward for countries where both CM and *A. lopezi* parasitoids are present. (Note: For these countries, national efforts usually would take priority, although regional/international contributions are not to be excluded entirely).	**Chairperson:** Ms. Areepan Upanisakorn **Rapporteur:** Ms. Alma Linda Abubakar [Group members: Participants from Cambodia, Laos, Vietnam, Thailand (selected participants), and others who choose to join in to assist]
10.00	• Tea/Coffee Break	
10.30	Preparation of Summary Group Reports • Each Group to draft Summary Report of the Group • On completion, Chairperson/Rapporteur to hand in Report to FAO Meeting secretariat for print multiplication • Chairperson/Rapporteur to also prepare report in electronic format (power point/word doc) for presentation in next session after lunch.	Chairpersons/Rapporteurs (and others who choose to help)

12.00	• Lunch Break	
	Technical Session V: **Presentation of Group Reports, General Discussions & Closing Remarks**	***Chairperson:*** *JW Ketelaar,* CTA-FAO Regional IPM/PRR Programme
13.30	• Presentation by Group 1	Group 1 Chairperson/Rapporteur
14.00	• Presentation by Group 2	Group 2 Chairperson/Rapporteur
14.30	• General discussions	
15.00	• Closing Remarks	*JW Ketelaar*
15.30	• End of FAO-TCP Project Final Meeting	
15.30	• Tea/Coffee Break	
18.00	• Farewell Dinner Cruise on Saigon River (hosted by FAO)	Remarks: JW Ketelaar, CTA FAO
8 November: Friday	Departure from HCMC Vietnam	

Annex 4-14 (only as Attachments)
Powerpoint Presentations by Presenters

1. FAO
Annex 4. TCP Project

2. GMS country reports
Annex 5. Thailand
Annex 6. Cambodia
Annex 7. China
Annex 8. Laos
Annex 9. Vietnam

3. International organizations
Annex 10. CIAT
Annex 11. CABI
Annex 12. AIT
Annex 13. GIZ-ASEAN-BCA

4. Field visit
Annex 14. Tay Ninh, Vietnam

27.11.2013