

# REPORT OF THE SECOND REGIONAL EXPERTISE TRAINING WORKSHOP ON PEST SURVEILLANCE

29 July-01 August 2014  
Hanoi, Viet Nam



## Summary

The 2nd Regional Expertise Training Workshop on Pest Surveillance has been implemented in Hanoi, Viet Nam from 29 July to 1 Aug. 2014 with 32 participants including 25 trainees from 5 participating countries, 5 experts and 2 RAP officers. Welcome remark was delivered by Mr. Chang-Ho Shin, Project Coordinator, on behalf of Dr. Yongfan Piao, Lead Technical Officer of the project and Senior Plant Protection Officer, RAP. Dr. Deuk-Soo Choi, Senior Researcher of Animal and Plant Quarantine Agency of the Korean Government, gave a lecture on “Fruit-fly surveillance and identification” as an expertise subject, which was followed by country reports on “Introduction of surveillance status and activities on fruit-fly” by Viet Nam, Thailand and Nepal experts. One more expertise subject “Stored product insect pest surveillance and identification” was delivered by Dr. Ki-Jeong Hong, Professor of Sunchon National University of Korea. As an expertise event, there was a field trip to “lychee orchard” where a Viet Nam government project on fruit-fly is being performed, making sure of placed pest traps and lures. Practical training has been implemented at the meeting room with two microscopes provided by Viet Nam NPPO, identifying diverse fruit-flies and stored

produce insect pests using the specimens and samples brought from participating countries. Just before concluding the workshop, there was a workshop appraisal by trainees through the questionnaires, asking to rate the level of lectures and lecturers, training contents and logistics. Mr. Shin delivered the closing remark, summarizing the agendas one by one with highlights of achievement made by the workshop. He concluded that the workshop was very good opportunity to share and to exchange the information on pest surveillance status among participating countries and to increase participants' practical capacity.

## **REPORT**

### **1. Welcome remark**

Mr. Shin, Project Coordinator, delivered the opening remark on behalf of Dr. Piao, Lead technical officer of FAO/RAP. He welcomed the participants and experts to the workshop and expressed his special gratitude to NPPO of Viet Nam for its sincere cooperation and elaboration as a hosting country of the workshop. He highlighted the importance of capacity development for pest surveillance and identification in South-East Asian countries and recommended participants to use this training as good opportunity to polish the knowledge and to share information and experience on pest surveillance and to maximize the benefit from the workshop.

### **2. Lecture on fruit-fly surveillance and identification**

Dr. Deuk-Soo Choi, Senior Researcher of Animal and Plant Quarantine Agency of the Korean Government, gave a lecture on fruit-fly as an expertise subject, introducing diverse kinds of fruit-fly's families one by one and their geographic distribution, species-level taxonomic characters as well as fruit-fly trapping and lures. He provided the trainees with reference books on the fruit-fly surveillance and identification to be used for their further study.

### **3. Country reports**

Three experts from Viet Nam, Thailand and Nepal presented country reports on "Introduction of surveillance status and activities on fruit-fly".

Dr. Ha Thanh Huong, Deputy Head of Plant Quarantine Division of Viet Nam NPPO, introduced the achievements of fruit-fly surveillance during 1977-2010 in Viet Nam and identification results for 4 kinds of fruit-flies as well as ongoing cooperation program with China on fruit-fly monitoring as well as various activities on fruit-fly in connection with trade market access strategies such as for dragon fruit (Japan, Korea, USA and New Zealand), mango fruit (Japan, Korea and New Zealand) and rambutan fruit (USA). She also introduced in detail the surveillance, detection, identification and preservation methods including

attractants, traps and specimens for fruit-fly and the procedures of Vapor Heat Treatment (VHT) from sorting stage to transport stage for export.

Dr. Sunyanee Srikachar, Plant Protection Research and Development Office of Thailand NPPO, introduced the current status of 9 kinds of fruit-flies existing in Thailand, describing their distribution, the number of hosts and economic pest status. She also introduced integrated fruit-fly control system performed in rose apples orchard for export including details of method on how to sanitize the orchards, how to monitor for population survey, how to use the protein bait and how to and when bag the fruits.

Mr. Dilli Ram Sharma, National Project Coordinator of Nepal, highlighted the importance of fruit-fly as main insect pest threatening the horticultural crops and their efforts to provide the farmers with national level of services regarding surveillance, monitoring and management of the pests. He also introduced 5 species of fruit-fly status in Nepal in connection with quarantine inspection in exporting Citrus fruit to China including distribution of fruit-fly, past survey on fruit-fly and damage aspect by the attack of fruit-fly as well as Citrus fruit-fly surveillance activities and their recent identification results. Regarding this matter, he specially requested to send an expert on taxonomy of fruit-fly to Nepal for further study and survey activities as one of project in-country programs.

#### **4. Lecture on Stored Product Insect Pest Surveillance and Identification**

Dr. Hong, Professor of Sunchon National University in Korea, gave a lecture on stored product insect pest as an expertise subject. He introduced various kinds of pest family one by one, describing their characteristics, classification, spreading aspects, damage aspects, boring capacities and survey methods with a lot of colorful pictures. He provided the trainees with reference books on the stored product insect pests surveillance and identification to be used for their further study.

#### **5. Field trip**

To experience real pest survey method, participants took a field trip to a lychee orchard which is around 120km away from Hanoi. In 3ha-wide lychee orchard, a lot of traps were placed for fruit-fly monitoring as one of Viet Nam government projects. Every trap was set up at a distance of 20m each other, using four kinds of chemical lure. A Viet Nam-NPPO officer guided the participants, explaining when and how to set up and remove the traps, what kinds of traps and lures they use, how often they change the lures, how long traps are placing and so on as well as general information on lychee cultivation.

#### **6. Laboratory practice**

To improve personal capacity in implementation of pest identification, laboratory practice has been included in the training program. Two microscopes were provided by Viet Nam NPPO for the practice. Microscope practice for fruit-fly identification was performed in the morning session, while stored products insect pest in the afternoon session. Participants actively participated in practical training to identify the pest species by using the pest specimens or samples brought from participating countries and by comparing the target pests with the pictures provided by lecturers. Participants were especially interested in the pest species closely related to market access or quarantine inspection of their own countries. They have learned how to differentiate between similar pest species by minute distinctions of morphological characters such as mouthpart, wing, abdomen, genitalia, vein, pupa, eggs, larva etc. as well as how to handle the microscopes and lab tools in pest identification. This practice session could contribute to improving expertise knowledge on pest's characteristics and trainees' identification skill, but they could not have enough time to practice because of limited number of equipment and insufficient space.

## **7. Workshop assessment**

As a last session of the workshop, prepared questionnaires were distributed to the participants to evaluate the workshop. Questionnaires were composed of five sections such as overall assessment of the project, rating the lecture and lecturers, rating the impact of the workshop, rating the logistics and description on the strength, weakness of the workshop and suggestion.

According to the result of the analysis of the questionnaires collected from 24 participants, 99% of the participants were content with overall project content, structure and organization and 97% of the participants were "satisfied" or "fully satisfied" with the lectures and lecturers' expertise. However, a third of participants were not satisfied with the field trip and laboratory practices. 95% of the participants think that this workshop will impact on their technical knowledge, professional activities, regional networking and improving the work service. As for the workshop logistics such as flight arrangement, accommodation, meeting facilities and other things, 93% of the participants expressed their satisfaction.

Meanwhile, participants described the main strength, weakness of the workshop and made suggestion as follows.

### <Strength>

- Lecturers' highly specialized expertise level and enthusiastic attitude
- Very good contents and arrangement of the training
- Good opportunity to increase capacity in pest identification
- Good interaction opportunity among participant countries

### <Weakness>

- Inefficient lab equipment and conference room in order to have enough practices
- Lack of information sharing on field trip

- Poor arrangement of field trip and no expert's guidance
- Not enough and limited distribution of hand-out (books)
- Short duration of training
- Poor logistic support (notebook, reading material, reference books etc.)
- No airport pick-up services and poor food of the hotel

<Suggestion>

- Distribution of enough technical books and colourful hand-outs
- Arrangement of enough lab equipment and conference room for practice
- Longer duration of training

## **8. Closing Remarks**

Mr. Shin expressed his gratitude to the lecturers and other participants for their hard work and cooperation as well as to Viet Nam NPPO for its sincere cooperation and arrangement for the workshop as a hosting country.

He evaluated the workshop as it was very good opportunity for the trainees to increase their expertise on two specialized subjects and to share information on each country's status on fruit-fly survey as well as to develop their practical capacity of pest identification through the field trip and lab practice training. On the other hand, he expressed a sense of frustration at inappropriate preparation of lab equipment and insufficient space for lab practices. To conclude the workshop, he recommended the trainees to keep digesting and reminding the contents of the lectures to maximize the benefit of training program, emphasizing that using this opportunity to increase country's capacity is quite important for the successful implementation of the project.

## **9. The results of the Workshop**

This workshop produced significant results in association with forthcoming training workshops as follow.

Firstly, participants could increase specialized knowledge on fruit-fly and stored product insect pests and have upgraded skill on how to identify pest species by their morphological characters with the pest specimens and samples through real microscope practice. Field trip contributed to increasing practical understanding on fruit-fly trap's functions such as how to set up the traps and how the traps are working. Detailed reference books provided by lecturers also enable the participants to have further study and to share with other colleagues.

Secondly, presentations on country reports were good material for the participants to share and exchange information on each country's fruit-fly survey status, concerned crops and related activities in association with export strategies.

Thirdly, although lab practices was surely good practical events in increasing the expertise level of the participants, participants could not have enough opportunity to take part in the practices because of insufficient and inefficient lab equipment as well as limited practice space. As we can see the results of the workshop assessment, many trainees pointed out this matter. In this regard, more careful attention has to be paid in preparation of lab practices for the forthcoming workshop.

Lastly, a matter for regret was that the trainees of Myanmar could not take part in the workshop this time again because of the delay of administrative decision-making procedures on the workshop participation.

## **10. A list of follow-up actions**

Based on the project work-plan and the results of this workshop, some actions to be followed up in implementation of the project will be as follows.

- Preparation of the 3<sup>rd</sup> regional expertise training workshop on pest surveillance and the 1<sup>st</sup> regional training workshop on pest information management.
- Preparation of Steering Committee to adjust the training program and project work-plan
- Consultation with hosting countries of the scheduled workshops about detailed training program
- Consultation with potential experts/trainers to adjust and finalize the in-country trainings
- Undertaking the procedures for laboratory equipment procurement to support diagnostic capacity of the participating countries
- Close collaboration with Myanmar NPPO for their participation in the next workshop

**Annex 1****Agenda for Regional Workshops on Pest Surveillance****Day-1 (July 29, 2014)**

<b>Time</b>	<b>Session</b>	<b>Facilitator</b>
09:00 – 09:30	Registration	
<b><i>Opening Session</i></b>		
09:30 - 09:45	Welcome remark	Dr. Yongfan Piao
09:45 - 10:00	Group photo and Coffee break	
<b><i>Session 1: Lecture (1)</i></b>		
10:00 - 12:00	Lecture on Fruit-fly surveillance and identification	Dr. Deuk-Soo Choi
12:00 - 13:30	Lunch	
<b><i>Session 2: Lecture (2)</i></b>		
13:30 – 14:10	Introduction of Surveillance Status and Activities on Fruit-fly in Viet Nam	Dr. Ha Thanh Huong
14:10 – 14:40	Introduction of Surveillance Status and Activities on Fruit-fly in Thailand	Ms. Sunyanee Srikachar
14:40 – 15:10	Introduction of Surveillance Status and Activities on Fruit-fly in Nepal	Mr. Dilli Ram Sharma
15:10 – 15:30	Coffee break	
<b><i>Session 3: Lecture (3)</i></b>		
15:30 – 17:20	Lecture on Stored product insect pest surveillance and identification	Dr. Ki-Jeong Hong
18:30 – 20:30	Welcome party	

**Day-2 (July 30, 2014)**

<b>Time</b>	<b>Session</b>	<b>Facilitator</b>
<b><i>Session 4: Field Trip</i></b>		
09:00 – 17:00	Field trip	NPC of Viet Nam

**Day-3 (July 31, 2014)**

<b>Time</b>	<b>Session</b>	<b>Facilitator</b>
<b><i>Session 5: Laboratory Practice</i></b>		
09:00 – 17:00	Laboratory practice for pest identification	NPC of Viet Nam, Dr. Choi and Dr. Hong

**Day-4 (Aug. 01, 2014)**

<b>Time</b>	<b>Session</b>	<b>Facilitator</b>
<b><i>Session 6: Training Assessment</i></b>		
09:30- 10:30	Training Assessment by questionnaires	Project Coordinator
<b><i>Session 7: Closing</i></b>		
10:30 – 11:00	Closing remark	Dr. Yongfan Piao

## Annex 2

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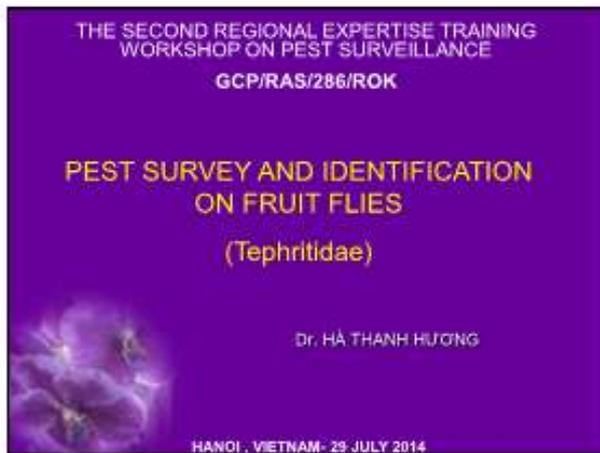
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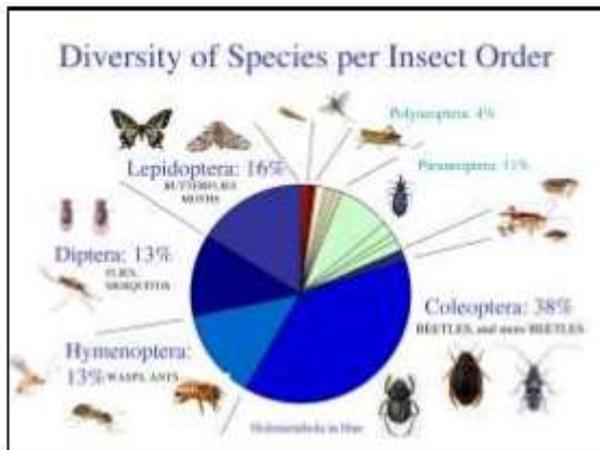
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## Annex 3.1 Country Report: Viet Nam



### CONTENTS

1. Introduction of surveillance status on fruit flies in Vietnam
2. Identification of some fruit flies species in Vietnam
3. Activities on fruit flies in Vietnam



Fruit flies (Diptera: Tephritidae) include some of the world's most serious agricultural pests. Besides causing billions of dollars in direct losses to a wide variety of fruit, vegetable and flower crops (e.g., citrus, apple, mango, sunflower), they limit the development of agriculture in many countries because of the strict trade quarantines imposed to prevent their spread. Of the more than 4,400 species known worldwide (Norrbon 2004), nearly 200 are considered pests.

Some fruit flies (Tephritidae) were quarantine pests of the USA, Australia, Japan, Vietnam,....

## INTRODUCTION OF SURVEILLANCE STATUS ON FRUIT FLIES IN VIETNAM

### ACHIEVEMENT SURVEILLANCE OF FRUIT FLIES

1. 1977-1978: Survey on 16 fruit tree species in Southern, including *Citrus* spp., *Mangifera indica*, *Musa* spp., *Ananas sativa*, *Zizyphus jujuba*, *Artocarpus integrifolia* (Jackfruit), *Nephellium lappaceum* (rambutan), *Psidium guajava*, *Vitis vinifera*, *Euphoria longana*, *Hylocereus undatus*, *Durio zibethinus*, *Anana reticulata*, *Garcinia mangostana*, *Eugenia jambos*, *Spondias cytherea*

Fruit trees	Collected and identified
<i>Citrus</i> spp.	<i>Bactrocera dorsalis</i>
<i>Mangifera indica</i>	<i>Bactrocera dorsalis</i>
<i>Zizyphus jujuba</i>	<i>Bactrocera dorsalis</i>
<i>Psidium guajava</i>	<i>Bactrocera dorsalis</i> <i>Bactrocera acurbitae</i>
<i>Vitis vinifera</i>	<i>Bactrocera dorsalis</i>
<i>Hylocereus undatus</i>	<i>Bactrocera dorsalis</i>
<i>Eugenia jambos</i>	<i>Bactrocera dorsalis</i>

## ACHIEVEMENT SURVEILLANCE OF FRUIT FLIES

2. **1997-1998:** Additional survey on 16 fruit tree species in Vietnam.

Fruit trees	Collected and identified
Citrus spp.	<i>Bactrocera dorsalis</i> <i>Bactrocera correcta</i>
<i>Euphoria longana</i> and <i>Litchi chinensis</i>	<i>Bactrocera dorsalis</i>
<i>Mangifera indica</i>	<i>Bactrocera dorsalis</i>
<i>Manilkara zapota</i> (L.) P. Royen	<i>Bactrocera dorsalis</i>
<i>Psidium guajava</i>	<i>Bactrocera dorsalis</i>
<i>Eugenia jambos</i>	<i>Bactrocera dorsalis</i>
<i>Nephelium lappaceum</i>	<i>Bactrocera dorsalis</i>
<i>Vitis vinifera</i>	<i>Bactrocera dorsalis</i>
<i>Hylocereus undatus</i>	<i>Bactrocera dorsalis</i>
<i>Prunus salicifolia</i>	<i>Bactrocera dorsalis</i>

## ACHIEVEMENT SURVEILLANCE OF FRUIT FLIES

3. **2006-2010:** Conducted a surveillance on major crops and post-harvest products in Vietnam. Survey on 8 fruit tree species, including:

- Pomelo - *Citrus grandis*,
  - Orange - *Citrus sinensis*,
  - Lime - *Citrus limonia*,
  - Tangerine - *Citrus reticulata*,
  - Longan - *Euphoria longana*,
  - Dragon - *Hylocereus undatus*,
  - Lichee - *Litchi chinensis*,
  - Mango - *Mangifera indica*.
- Collected and identified: *Bactrocera dorsalis*, *Bactrocera correcta*

## ACHIEVEMENT SURVEILLANCE OF FRUIT FLIES

4. **2010:** Conducted a surveillance on major crops in south Vietnam

Stt	Scientific name of fruit fly	Host
1	<i>Bactrocera correcta</i> (Bezzi)	Mango
2	<i>Bactrocera dorsalis</i> (Hendel)	Mango

## 5. COOPERATION PROGRAM BETWEEN VIETNAM AND CHINA ON FRUIT FLIES MONITORING IN BORDER AREAS

- From 2009-2013:
- Trapped:
  - 2009: 169
  - 2010: 387
  - 2011: 216
  - 2012: 204
  - 2013: 236
  - Total: 1212
- Collected places:
  - 2009: 24
  - 2010: 27
  - 2011: 24
  - 2012: 24
  - 2013: 28
  - Total: 28

### LIST OF MAJOR FRUIT FLIES IN VIETNAM

No	Scientific name of fruit fly	Traps
1	<i>Bactrocera correcta</i> (Bezzi)	Me, Pb
2	<i>Bactrocera dorsalis</i> (Hendel)	Cue, Me, Pb
3	<i>Bactrocera cucurbitae</i> (Coquillett)	Cue, Me, Pb
4	<i>Bactrocera tau</i> (Walker)	Cue, Pb

## SURVEILLANCE METHOD

- **PURPOSE:**
  - Pest status and survey types
  - Pest present under eradication, The pest is present and subject to control measures. Includes FFALPP
  - Detection surveys, applied to determine if the pest is present in an area
- **METHOD FOR DETECTION**
- **IDENTIFY**
- **RECORD**

## METHOD FOR DETECTION

- **Fruit flies may be detected**
  - as eggs or larvae in fruit imports, as attacked growing fruit or as adults caught in detection
  - as adults caught in monitoring traps
- **Collecting attacked fruit:**
  - Collected fruit had puncture marks made by the entry of the female's ovipositor in the field.
  - Field sampling should be transported to the Lab.
  - In Lab., sampling fruit should be placed in a container. Sample should be checked every 2 days for pupa and larvae have emerged should be discarded
  - Pupa can be transferred to Petri dishes and provide some sugar solution as food for the emerging adults and to keep the adult alive for at least 4 days after emergence (flies will be develop their full body coloration and normal shape)

## COLLECTING ATTACKED FRUIT



## METHOD FOR DETECTION

- **Fruit fly trapping and baits**
  - Population of fruit flies are sometimes first detected in monitoring traps set in areas susceptible to fruit fly attack.
  - The male of most *Bactrocera*, *Ceratitis*, *Dacus* genus can be collected in traps. Male lures are Methyl Eugenol (ME), Cue Lure (CuE), Trimedlure (TML)
  - Both females and males of any fruit associated species may be collected in traps baited (e.g. yeast autolysate, hydrolyzed protein or ammonium carbonate)

## TYPE OF ATTRACTANTS AND TRAPS



## ATTRACTANT AND TRAPS FOR FRUIT FLIES SURVEYS

- **FOR MALE FRUIT FLIES SURVEYS**
  - ISPM 26, Appendix 1, table 2a
  - Attracts the males of some *Bactrocera* spp.
    - 81 species recorded at methyl eugenol
    - 211 species recorded at cue lure
- **FOR FEMALE FRUIT FLIES SURVEYS**
  - ISPM 26, Appendix 1, table 2b

## DETECT A TRAP/BAIT PLACEMENT

- Used GPS to detect each trapping or bait

Site No	S. P. 0010		S. P. 0010		S. P. 0010		S. P. 0010	
	Site No	Lat (N)	Site No	Lat (N)	Site No	Lat (N)	Site No	Lat (N)
1001	2771120	10742100	1002	2771120	10742100	1003	2771120	10742100
1004	2771120	10742100	1005	2771120	10742100	1006	2771120	10742100
1007	2771120	10742100	1008	2771120	10742100	1009	2771120	10742100
1010	2771120	10742100	1011	2771120	10742100	1012	2771120	10742100
1013	2771120	10742100	1014	2771120	10742100	1015	2771120	10742100
1016	2771120	10742100	1017	2771120	10742100	1018	2771120	10742100
1019	2771120	10742100	1020	2771120	10742100	1021	2771120	10742100
1022	2771120	10742100	1023	2771120	10742100	1024	2771120	10742100
1025	2771120	10742100	1026	2771120	10742100	1027	2771120	10742100
1028	2771120	10742100	1029	2771120	10742100	1030	2771120	10742100
1031	2771120	10742100	1032	2771120	10742100	1033	2771120	10742100
1034	2771120	10742100	1035	2771120	10742100	1036	2771120	10742100
1037	2771120	10742100	1038	2771120	10742100	1039	2771120	10742100
1040	2771120	10742100	1041	2771120	10742100	1042	2771120	10742100
1043	2771120	10742100	1044	2771120	10742100	1045	2771120	10742100
1046	2771120	10742100	1047	2771120	10742100	1048	2771120	10742100
1049	2771120	10742100	1050	2771120	10742100	1051	2771120	10742100
1052	2771120	10742100	1053	2771120	10742100	1054	2771120	10742100
1055	2771120	10742100	1056	2771120	10742100	1057	2771120	10742100
1058	2771120	10742100	1059	2771120	10742100	1060	2771120	10742100
1061	2771120	10742100	1062	2771120	10742100	1063	2771120	10742100
1064	2771120	10742100	1065	2771120	10742100	1066	2771120	10742100
1067	2771120	10742100	1068	2771120	10742100	1069	2771120	10742100
1070	2771120	10742100	1071	2771120	10742100	1072	2771120	10742100
1073	2771120	10742100	1074	2771120	10742100	1075	2771120	10742100
1076	2771120	10742100	1077	2771120	10742100	1078	2771120	10742100
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1175	2771120	10742100	1176	2771120	10742100	1177	2771120	10742100
1178	2771120	10742100	1179	2771120	10742100	1180	2771120	10742100
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1184	2771120	10742100	1185	2771120	10742100	1186	2771120	10742100
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1193	2771120	10742100	1194	2771120	10742100	1195	2771120	10742100
1196	2771120	10742100	1197	2771120	10742100	1198	2771120	10742100
1199	2771120	10742100	1200	2771120	10742100	1201	2771120	10742100

## TRAP PLACEMENT

- Trap placement: 1.5 m above ground
- The distance between the trap: > 30m, other traps lure or bait must be separated by 3m
- The density of traps: Me, Cue and TML, each type 3-12 traps/km<sup>2</sup>
- Traps must have signs and use GPS positioning

## TRAP PLACEMENT



## TRAP PLACEMENT



## ADDITIONAL OR REPLACEMENT ATTRACTANT AND TRAPS

- ①- Me and Cue attractants usually added 1 month/time, each time adding 2-3ml. Cotton must be replaced after 2 months.
- ②- Each month instead TML attractant, each time 1 table.
- ③- Each 15 days instead Pb bait, each time 3 tables

## COLLECTED METHODS

- Collect specimen in trap: 15 days/time
- Minimum number of specimen: at least 3 specimens / one species
- Currating method: Pinned
- Collection techniques: traps (attractive or bait)
- Keeping specimens:
  - Kill Jar: to keep only specimens from a single locality together with label
  - Freezer: to keep fresh specimens with label

## PRESERVATION METHOD

- Specimen Labels, Types of Labels
- 1. Locality Label
  - Country, state/territory, province), and county (township) information should be presented across the top of the label
  - A general descriptive geographic location, including a site name, how many kilometers and compass direction from the nearest major specific map location; town, mountain peak, lake, specific park or refuge, etc.
  - A specific geographic location
  - Date of collection: The date should include the year, month and day
  - The name of the person(s) collecting the specimen should appear at the bottom of the label
- 2. Additional Information Labels
- 3. Taxonomic Name, Determination Label: provides the name of the specimen, to the lowest taxonomic rank possible (species or subspecies)
- Labels for Different Preservation Methods
  - Specimen-pinned dry: Labels are positioned under the specimen on the pin. A locality label is on top, and a taxonomic identification label underneath the locality label. The labels should be oriented parallel to the longitudinal axis of the specimen, positioned to be read from the left side of the specimen

### Locality Label:

USA NM Bernalillo Co  
1 km S 1.25, 8 km W  
Albuquerque, 1762 m a.s.l.  
N 35° 1.79' W 106° 04.16'  
23 August 2000  
Coll. R. Anderson

### Other Information:

Desert grassland, 2000 m elev  
Sweep net from *Abolplex canescens*

### Determination Label:

*Aeolopyodes elegans* (Scudder)  
Det. D.C. Lightfoot 2001

Note: We recommend 4 font size, Arial font as used in the examples above. These labels were created with MS Word, using the line drawing feature. The lines around the labels are not necessary, but used above to define the appropriate label size

## PRESERVATION METHOD

### ADULT:

- **Pinning:** Fruit flies are pinned dorsal side up at a specific place on their body.
- Diptera specimens are often glued to special paper points.
- The fruit flies is glued to the tip of the point dorsal side up.
- The point is then mounted on an insect pin about 6mm from the top of the pin



## COLLETED SPECIMENTS



## IDENTIFY

- From specimen of fruit flies to morphological identify to species



## IDENTIFY

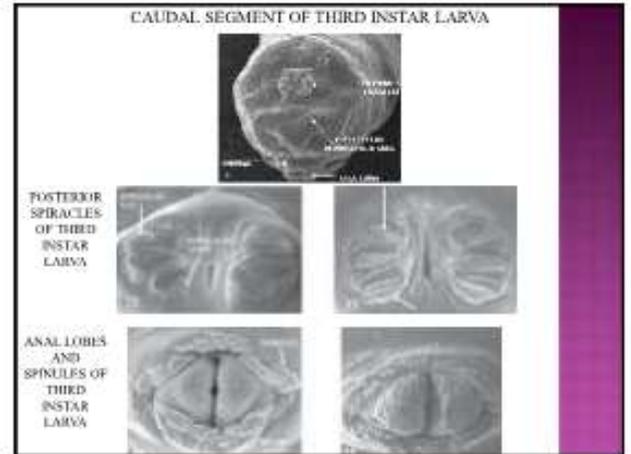
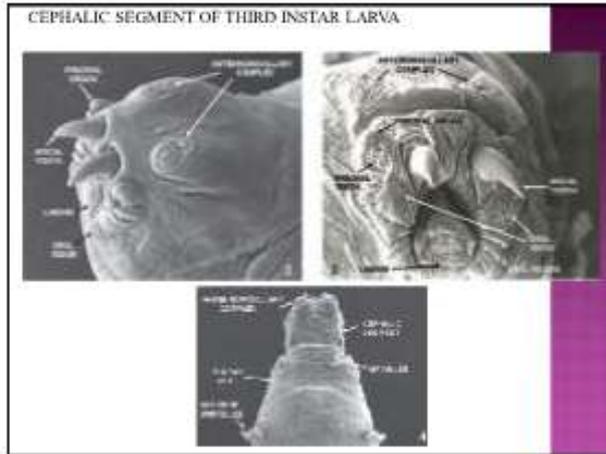
- **Key to adults:** White I.M and Elson-Harris M.M, 1992. Fruit flies of economic significance: their identification and bionomics, Page 53-111
  - Key to Bactrocera and Dacus species
  - Key to Anastrepha species
  - Key Ceratitis species
- **Morphological diagnosis of adult fruit flies include:**
  - Wing morphology and infuscation
  - Presence or absence of various setae, and relative setal size
  - Overall colour and colour patterning
  - Presence, shape and colour of thoracic vittae. A vitta is a band or stripe of colour

## IDENTIFY

- **Key to third instar larvae:** White I.M and Elson-Harris M.M, 1992. Fruit flies of economic significance: their identification and bionomics, Page 112-127



MOUTHHOOK OF THIRD INSTAR LARVA



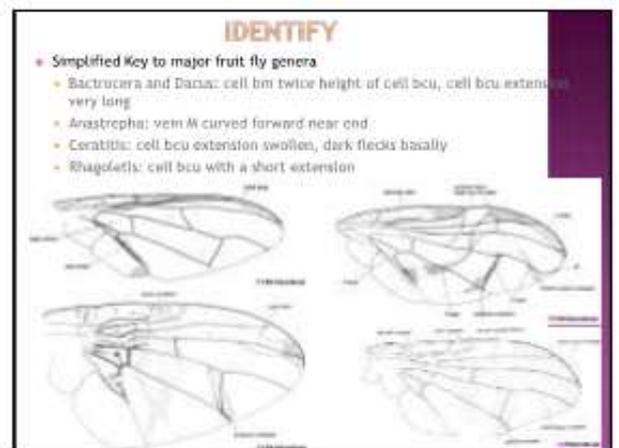
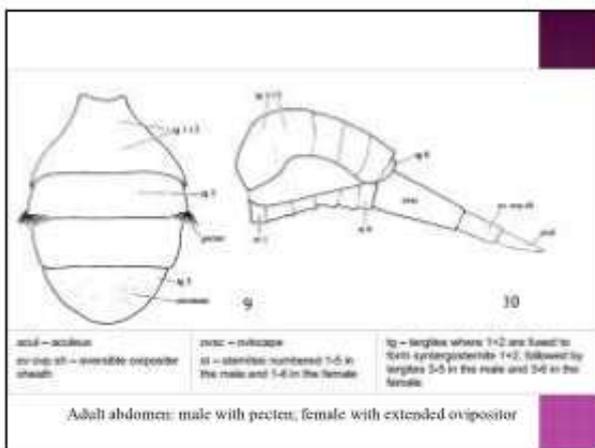
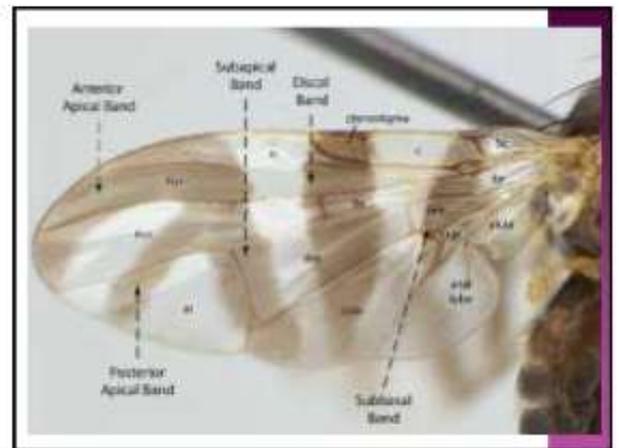
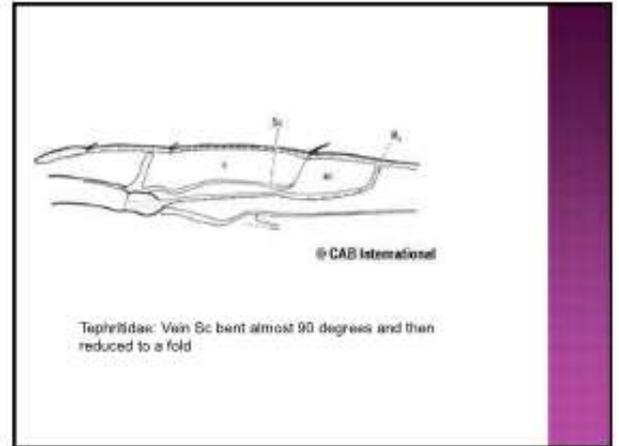
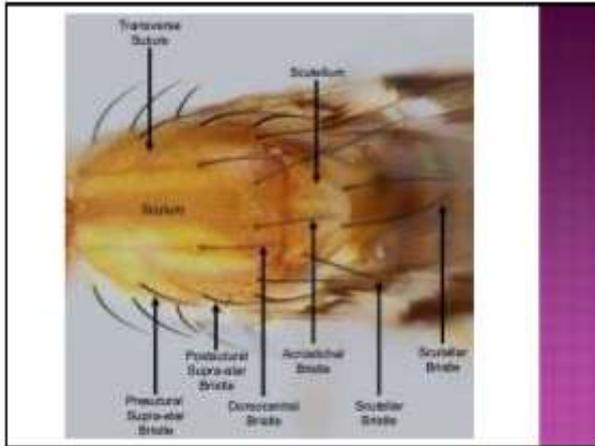
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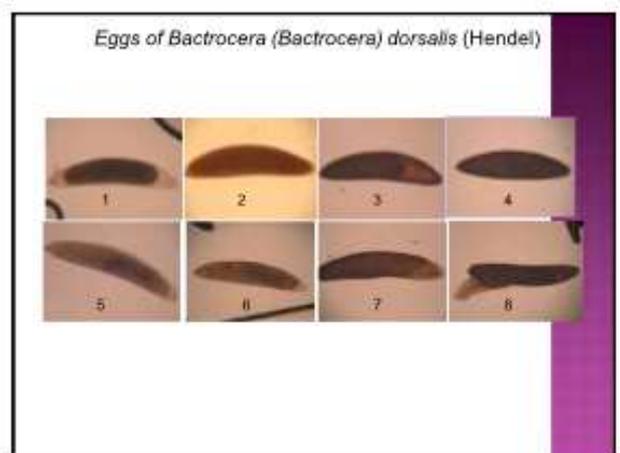
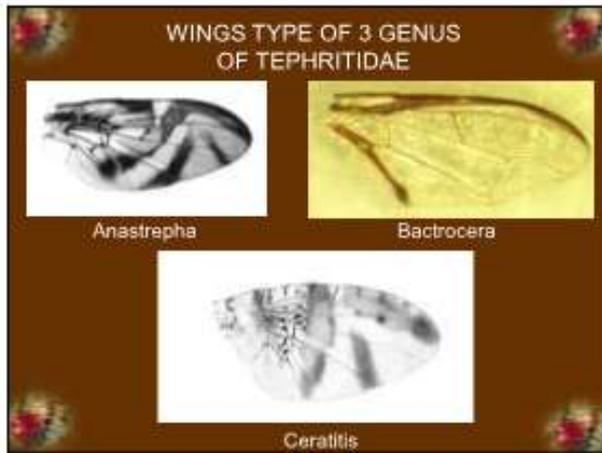
- Key to pupa: Teichi Yamada, Susumu Nakagawa and Hitoshi Kamasaki, 1963. Identification of three species of reared Hawaiian fruit fly pupae. Vol. XVIII, No.2, July 1963, Page 319-321

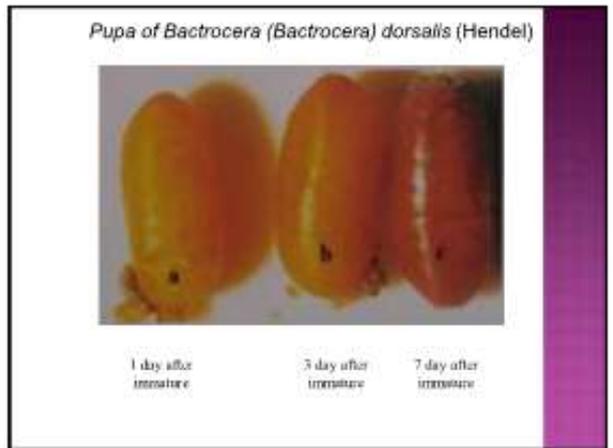
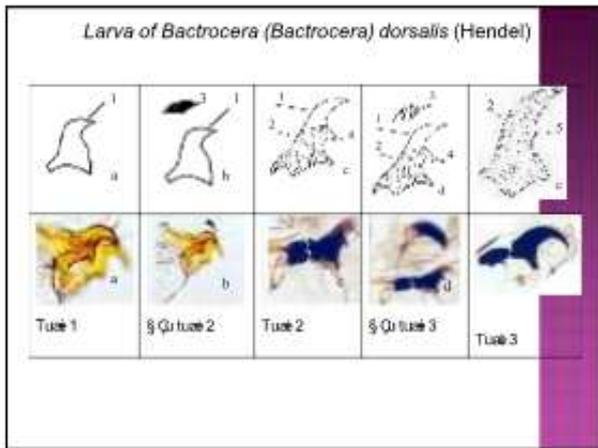
*E. cucurbitae*      *E. dorsalis*

a,b: anterior ends  
d,e: anterior spiracles and a faint M-shaped row of pits of









Fruit flies	Dimensions (mm)		Wing
	Body	Wing	
<i>B. dorsalis</i>	7,56±0,14 (7,0-8,30)	6,14±0,05 (6,0-6,20)	
<i>B. correcta</i>	6,27±0,15 (5,20-6,80)	5,12±0,03 (5,0-5,20)	
<i>B. cucurbitae</i>	9,62 ±0,22 (8,40-10,0)	6,12 ±0,02 (6,0-6,20)	
<i>B. tau</i>	9,44±0,16 (9,05-10,07)	6,73±0,06 (6,61-6,83)	

## ACTIVITIES ON FRUIT FLIES IN VIETNAM

### VIETNAM DRAGON FRUIT

- For Japan, Korea and New Zealand market access
- Vietnam exported dragon fruit into Japan by Vapor Heat Treatment (VHT) to treat fruit flies on this fruit before exportation
- For the United States market access
- Vietnam exported dragon fruit into the United States by Irradiation to treat fruit flies on this fruit before exportation

### VIETNAM MANGO FRUIT

- For Japan market access
- Start submitted technical information packages for NPPO's Japan since 2011, NPPO's Vietnam has so far completed experiments with fruit flies by Vapor Heat Treatment (VHT) and sent to Japan the research results to consider
- For Korea and New Zealand market access
- Vietnam exported mango fruit into Korea by Vapor Heat Treatment (VHT) to treat fruit flies on this fruit before exportation

### VIETNAM RAMBUTAN FRUIT

- For the United States market access:
- Vietnam exported rambutan fruits into the United States by Irradiation to treat fruit flies on this fruit before exportation

### EXPERIMENTS OF VHT FOR FRUIT FLIES IN LAB.



### VAPOR HEAT TREATMENT FACILITY

### SORTING AND CLEANED



### FRUITS ARE PROCESSED IN VHT MACHINE AND SET TEMPERATURE SENSORS



### INSTALL THE HEAT TREATMENT SYSTEM



### COOLING AND ISOLATED ROOM



### PACKAGING AND STORAGE



### TRANSPORT TO EXPORT



## Annex 3.2 Country Report: Thailand

Regional Expertise Training Workshop on Pest Surveillance  
Hanoi, Viet Nam, 29 July - 1 August 2014

### Introduction of Surveillance Status and Activities on Fruit-fly in Thailand

Sunyane Srikachar



Plant Protection Research and Development Office,  
Department of Agriculture, Thailand

### Topics

- Introduction
- Status of Fruit Flies in Thailand
- Integrated fruit flies control in rose apples orchard for export



Plant Protection Research and Development Office, Department of Agriculture, Thailand



- Thailand is the 50<sup>th</sup> largest country in the world; most nearly in size to Spain.
- Thailand covers 510,890 sq km of land and 2,230 sq km of water.
- Thailand has a tropical climate and temperatures typically rang from 19 to 38 degrees C (66-100F).
- The economy of Thailand is reliant on exports, which account for 60% of Thailand approximately US\$ 200 billion GDP. The economy of Thailand is the 2<sup>nd</sup> largest in Southeast Asia. Thailand's exports consist primarily of agricultural products including fish and rice, of which it is the largest exporter in the world.

### Classification of Fruit Flies

PHYLUM	ARTHROPODA
CLASS	INSECTA
ORDER	DIPTERA
FAMILY	TEPHRITIDAE

Fruit Flies = 4,000 species (500 genera)  
35% or 1,400 species = attack soft fruits



### Status of Fruit flies in Thailand

1. *Bactrocera (Bactrocera) dorsalis* (Hendel)
2. *Bactrocera (Bactrocera) correcta* (Bezzi)
3. *Bactrocera (Bactrocera) carambolae* Drew and Handcock
4. *Bactrocera (Bactrocera) latifrons* (Hendel)
5. *Bactrocera (Bactrocera) umbrosa* (Fabricius)
6. *Bactrocera (Bactrocera) zonata* (Saunders)
7. *Bactrocera (Zeugodacus) cucurbitae* (Coquillett)
8. *Bactrocera (Zeugodacus) tau* (Walker)



Plant Protection Research and Development Office, Department of Agriculture, Thailand



*Bactrocera (Bactrocera) dorsalis* (Hendel)

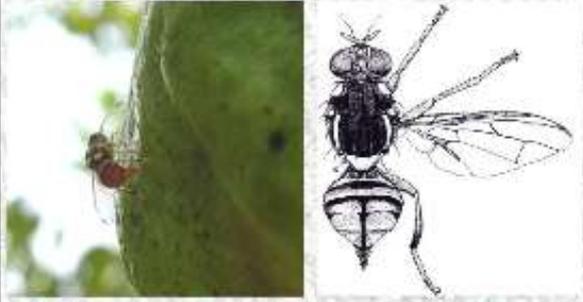


Plant Protection Research and Development Office, Department of Agriculture, Thailand



Distribution: cover country  
 Hosts : 52 sp. (Jirasurat,1994)  
 Economic pest status:  
 A major pest species

Plant Protection Research and Development Office, Department of Agriculture, Thailand



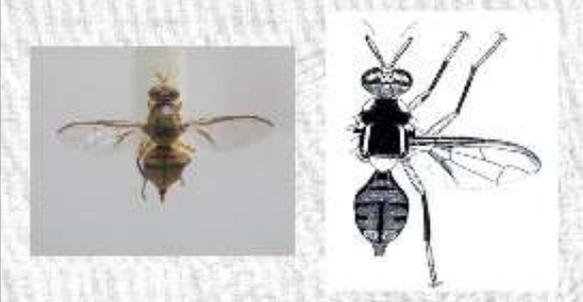
*Bactrocera (Bactrocera) correctata (Bezzi)*

Plant Protection Research and Development Office, Department of Agriculture, Thailand



Distribution: cover country  
 Hosts: 36 sp. (Jirasurat,1994)  
 Economic pest status:  
 A major pest species

Plant Protection Research and Development Office, Department of Agriculture, Thailand



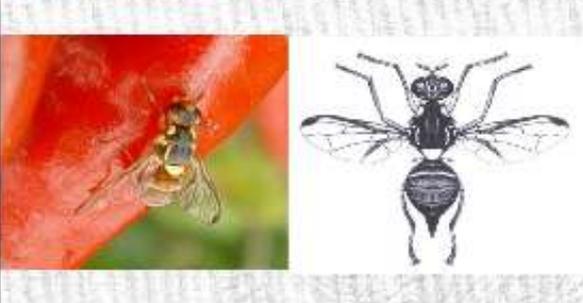
*Bactrocera (Bactrocera) carambolae Drew & Hancock*

Plant Protection Research and Development Office, Department of Agriculture, Thailand



Distribution: south part of Thailand  
 Hosts: 6 sp. (Jirasurat,1994)  
 Economic pest status:  
 A major pest species

Plant Protection Research and Development Office, Department of Agriculture, Thailand



*Bactrocera (Bactrocera) latifrons (Bendal)*

Plant Protection Research and Development Office, Department of Agriculture, Thailand



Distribution: cover country  
 Hosts: Solanaceae (9 sp.)(Jirasurat,1994)  
 Economic pest status:  
 A medium level pest species

Plant Protection Research and Development Office, Department of Agriculture, Thailand



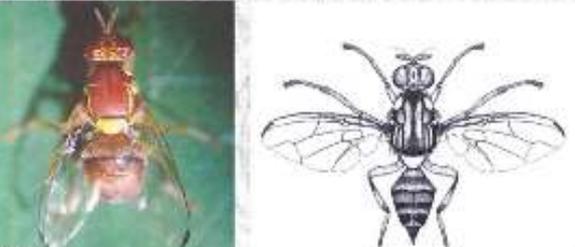
*Bactrocera (Bactrocera) umbrosa (Fabricius)*

Plant Protection Research and Development Office, Department of Agriculture, Thailand



Distribution: cover country  
 Hosts: Moraceae (3 sp.) (Jirasurat,1994)  
 Economic pest status:  
 A low level pest species

Plant Protection Research and Development Office, Department of Agriculture, Thailand



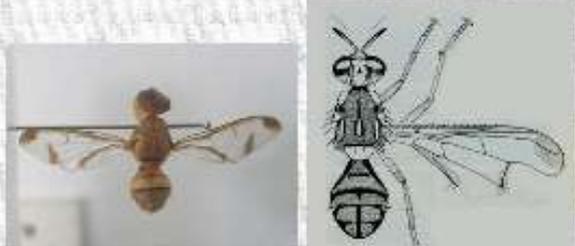
*Bactrocera (Bactrocera) zonata (Saunders)*

Plant Protection Research and Development Office, Department of Agriculture, Thailand



Distribution: north part of Thailand  
 Hosts : 2 sp. (Jirasurat,1994)  
 Economic pest status:  
 A medium level pest species

Plant Protection Research and Development Office, Department of Agriculture, Thailand



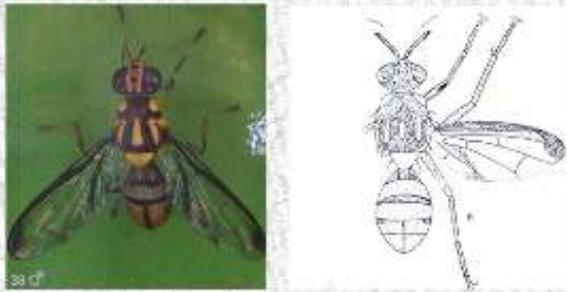
*Bactrocera (Zeugodacus) cucurbitae (Coquillett)*

Plant Protection Research and Development Office, Department of Agriculture, Thailand



Distribution: cover country  
 Hosts : 21 sp. (Jirasurat,1994)  
 Economic pest status:  
 A major pest species

Plant Protection Research and Development Office, Department of Agriculture, Thailand



*Bactrocera (Zeugodacus) tau (Walker)*

Plant Protection Research and Development Office, Department of Agriculture, Thailand



Distribution: cover country  
 Hosts : 11 sp. (Jirasurat,1994)  
 Economic pest status:  
 A low level pest species

Plant Protection Research and Development Office, Department of Agriculture, Thailand

Integrated fruit flies control  
 in Rose Apples orchard for export



In Thailand: 3 species of fruit flies infested in rose apples



*B. dorsalis* was a primary pest

**Integrated Pest Management Fruit flies  
 in rose apples**

Recommendation

- Sanitizing
- Monitoring
- Using protein bait
- Bagging

**1. Sanitizing**

- pruning the canopy



**1. Sanitizing**

- removing infested fruits from orchards



**2. Monitoring**

**The population survey of fruit flies**

- use Steiner's trap (20 traps per acre)
- methyl eugenol + malathion 57%EC
- control method needed when  $>1$  FF/trap/day




Modified trap



Steiner's trap




Modified trap

**3. Using protein bait**

- 200 ml protein hydrolysate
- 10 ml malathion 57% EC
- 5 liters of water



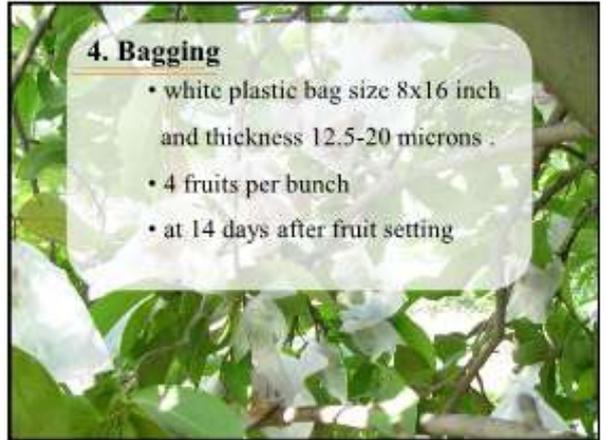
### 3. Using protein bait

- spot spraying



### 4. Bagging

- white plastic bag size 8x16 inch and thickness 12.5-20 microns .
- 4 fruits per bunch
- at 14 days after fruit setting



14 Days



at 14 days after stamens fell off



### Conclusion

#### Integrated Fruit flies control in Orchard:

- Sanitizing
- Monitoring
- Using protein bait
- Bagging



Thank you for your attention



## Annex 3.3 Country Report\_Nepal

Regional Expertise Training Workshop on Pest Surveillance

### Pest Surveillance activities on Fruit fly in Nepal



Hanoi, Viet Nam 29 July – 01 August 2014

**Dilli Ram Sharma**  
Program Director  
and  
Head, National Plant Protection Organization, Nepal

### Coverage of presentation

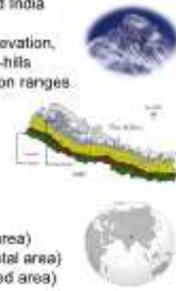
- Country Profile
- Background Information
- Introduction (The Fruit Flies)
- The quarantine fruit fly species to export citrus fruit to China
- Fruit fly in Nepal
- Citrus Fruit Fly Surveillance activities in Nepal
- Conclusion



### Country Profile: Nepal

**Geography:**  
**Location:** Southern Asia, between China and India  
**Area:** 147,181 km<sup>2</sup>  
**Climate:** The climate in Nepal varies with elevation, tropical in the lower southern part Terai, mid-hills alpine and the high mountains *poies*; elevation ranges from 90 to 8848 meters.  
**Population:** 26.6 million (2011 census)  
**Currency:** Nepalese Rupee (NPR)

**Land use:**  
**Total area:** 147181 km<sup>2</sup>  
**Cultivated area:** 3091000 ha. (29% of total area)  
**Noncultivated area:** 1030000 ha. (6.9% of total area)  
**Irrigated area:** 1331521 ha. (43% of cultivated area)



### The Country

Land locked country  
 Birth place of **Lord Buddha**

**Bordering countries:**

- China (Tibet): North
- India: East, south and west

**Geographical region:** (3)  
 Altitude ranges from few meters to 8,848m (Mt Everest; the highest peak of the world)

**Major crops:** Rice, Wheat, Maize, vegetables, potatoes and fruits.  
 Tea, Coffee, Sugarcane, Jute and cardamom



### Geographical and Political division of Nepal

**Geographical division: 3 Eco-zones**

**Mountain region**

- Covers about 33% of total area (4800 sqm and above)
- Valley, steep, alpine zone (Tropical) and main source of the majority of people in this region.

**Hilly region**

- Covers about 42% area (200 to 4800 mtd.)
- Agricultural (fruits, vegetables and horticultural production in the region are the main source of income of the people.

**Terai (lowland region)**

- Covers about 29% of the total area (~100 mtd.)
- This region serves as a main source of food supply to other regions of the country.

**Administrative division**

- 5 Development regions
- 75 Districts
- 3995 Village Development Committees



### Background Information

Fruit flies are one of the world's most destructive horticultural pests and pose risks to most commercial fruit and vegetable crops.

Worldwide there are 4,000 species of fruit flies in the family Tephritidae of which around 350 species are of economic importance (Asian Fruit Fly IPM Project, 2011). That cause direct damage to fruits and vegetables which can lead to up to 90-100% yield loss depending on fruit fly population, locality, variety and season.

In addition, to the direct losses, fruit fly infestation can result in serious losses in trade value and export opportunity due to strict quarantine regulations imposed by most importing countries.



**Introduction (The Fruit Flies)**

Fruit flies as a number of species infest a wide variety of fruits, vegetables, flower heads, seeds, leaves and other plant parts (Prabhakar et al., 2012).

They are found in nearly all habitats with suitable plant life. Their distribution is cosmopolitan covering tropical, subtropical and temperate regions (Agarwal and Susyoshi, 2005).

**Scientific classification**  
 Kingdom: Animalia  
 Phylum: Arthropoda  
 Class: Insecta  
 Order: Diptera  
 Family: Tephritidae  
 Subfamily: Dacninae  
 Tribe: Dacini  
 Genus: *Bactrocera*



**Introduction**

Nepal has vivid geo-climatic conditions and different types of fruits and vegetables are growing here. Among the different pest problems of these horticultural crops fruit fly is an important insect pest in Nepal.

Farmers are practicing use of pheromone traps, application of chemical measures and field sanitation as management options.

In Nepal MoAD / NPPO and its offices in regional, district and service centre level provides the services regarding surveillance, monitoring and management of insect pests.



**The quarantine fruit fly species to export citrus fruit to China**

- Bactrocera correcta* (Bezzi), Guava fruit fly 
- Bactrocera cucurbitae* (Coquillett), Melon fruit fly 
- Bactrocera dorsalis* (Hendel), Oriental fruit fly 
- Bactrocera tsuneonis* (Miyake), Japanese orange fly 
- Bactrocera zonata* (Saunders), Peach fruit fly 

**Fruit fly in Nepal**

In Nepal, Fruit flies are among the major pests of cucurbitaceous vegetables and citrus fruits.

Several study and research activities were conducted to prevent yield loss.

GC in 2001 mentioned there was 42-68% fruit attack by this insect in bitter gourd.

**Fruit fly in Nepal**

Hardy (1964) studied 11 species of fruit flies collected by the British Museum (Natural History) Nepal expedition teams (1954, 1961-62) and described 5 new species of it from Nepal.

Kapoor and his associates also mentioned these flies of Nepal in their book Fruit flies of India, 1980. There are 32 species under 18 genera among them 6 species are described from Nepal.

Fruit fly in Nepal cont..

- A survey was done in Kathmandu valley and adjoining district Kavre in 1994-96 and found that-

Kathmandu		Kavre	
Year/Period	Month	Year/Period	Month
1994-1996	February-December	1996	May-September
Critical period	March-Nov	Critical Period	May-Jun

- B. yoshimotoi* was found only during June-Sept
- B. dorsalis* and *B. cucurbitae* was found to be more in Kathmandu and
- B. Zonatus* and *B. cucurbitae* found in Kavre
- The observation showed that *B. cucurbitae* not only damage vegetables but it equally problem in fruits.

**Fruit fly in Nepal**

During the working period of (1990-1995), We had collected and there are 6 reference fruit fly species are available in Entomology laboratory of Fruit Development Directorate, Kirtipur. These are *Bactrocera dorsalis*, *B. cucurbitae*, *B. zonata*, *B. tau*, *B. scutellaris* and *B. yashimotoi*.



Pest Surveillance activities on Fruit fly in Nepal

**Fruit fly in Nepal**

There are 9 fruit flies species of Nepal reported by Entomology Division of NARC, Khumaltar, Nepal.

1. *Bactrocera caudatus* (Fabricius, 1805),
2. *Bactrocera corectus* (Bezzi, 1913),
3. *Bactrocera cucurbitae* (Coquillett, 1899),
4. *Bactrocera diversus* (Coquillett, 1904),
5. *Bactrocera dorsalis* (Hendel, ),
6. *Bactrocera minax* (Enderlein),
7. *Bactrocera scutellaris* (Bezzi, 1913),
8. *Bactrocera tau* (Walker) and
9. *Bactrocera zonatus* (Saunders, 1841).

Pest Surveillance activities on Fruit fly in Nepal

**Fruit fly in Nepal**

Citrus fruit flies are the most serious insect pest of sweet orange and hill lemon in the eastern hills of Nepal. Chinese citrus fly (*Bactrocera minax*) is very serious insect causing up to 97 % loss by the end of harvesting season. It has been recognized as a serious pest of commercial sweet orange, especially in eastern regions of Nepal and is considered one of the major limiters of production.

Despite several years of effort to control fruit flies through male annihilation using methyl eugenol and affected fruits sanitation tactics, fruit losses of sweet-orange did not decrease at the farm of NCRP Dhankuta and farmer's fields of eastern region of Nepal. Since last five years even mandarin fruits are being damaged (about 15%) by the fruit flies (NCRP, 2012).



Pest Surveillance activities on Fruit fly in Nepal

**Fruit fly in Nepal**

A study in National Citrus Research Program (NCRP), Paripatie Dhankuta in 2006 confirmed that Chinese citrus fly (*Bactrocera minax*) is the species affecting the citrus fruits of NCRP, Dhankuta and vicinity areas but not the oriental fruit fly.

- These previous studies confirmed that in eastern part of Nepal the problematic fruit fly species is *Bactrocera minax*. Thus, there is strong need to identify appropriate method of monitoring and management.

Pest Surveillance activities on Fruit fly in Nepal

**Fruit fly in Nepal**

- The fruit fly trap (pheromone trap) was found very useful in terms of minimizing damage caused by fruit fly and farmers also liked this technology very much (Jaisawal et.al., 1997).
- In Nepal, The pest management programme of fruit fly included the farmer's awareness; male annihilation by using parapheromones (cue lure for *Bactrocera cucurbitae* and methyl eugenol for *B. dorsalis*) and field sanitation have received tremendous interest and support of the farmers and will be continued.

Pest Surveillance activities on Fruit fly in Nepal

**Citrus Fruit Fly Surveillance activities in Nepal**

- Mid hill district of Nepal is renowned for citrus fruits and has potential to produce quality and more fruit not only for national market but also for export.
- Moreover, Nepalese government and Chinese government had signed in the agreement to export Citrus fruit (Mandarin from Syangja and Sweet Orange from Sindhuli) from Nepal in 2012.
- For the exportable citrus fruits farmers should produce quality fruits and there should not be presence of quarantine pests in fruit to export and citrus orchard too. (Obligation to full fill )
- Citrus orchard should make pest free and for that National Plant Protection Organization (NPPO) had conducted general survey surveillance of fruit fly regularly.



Pest Surveillance activities on Fruit fly in Nepal

### Citrus Fruit Fly Surveillance activities in Nepal

**Pest Surveillance activities on Fruit fly in Nepal**

- Pest status survey in Sindhuli and Syangja districts during 2012-13.
- In survey team there was involvement of experts from different sectors such as PPD, RPPL, Entomology and Plant Pathology Division of NARC, NCRP, NPQP, RAD and DADO (Adhikari, 2013).
- Report on Pest Status Survey in 2013 mentioned that there were two species of fruit fly found in survey sites i.e. *Bactrocera cucurbitae* and *Bactrocera dorsalis*.



### Citrus Fruit Fly Surveillance activities in Nepal

**Pest Surveillance activities on Fruit fly in Nepal**

- Recently, NPPO had endorsed the protocol for survey surveillance of fruit fly and activities for field survey in two districts namely Sindhuli and Syangja are ongoing.
- Protocol
- Fruit fly traps according to the protocol has been fixed with pheromone lure (Methyl eugenol and Cue lure) and Protein hydrolysis bait for monitoring of fruit fly species, their identification and preparation of database.



### Fruit fly in Nepal

**Pest Surveillance activities on Fruit fly in Nepal**

Preparation of pheromone traps by farmers and trapped fruit flies in Nepal

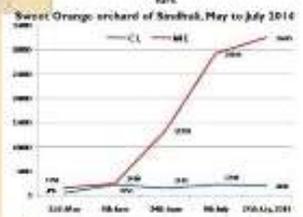


### Collection of trapped fruit flies

**Pest Surveillance activities on Fruit fly in Nepal**

Number of fruit flies trapped in Methyl eugenol and cue lure

Sweet Orange orchard of Sindhuli, May to July 2014



- The fruit flies trapped in methyl eugenol was found higher than those trapped in cue lure. The fruit flies trapped in methyl eugenol are increasing in trend till date.
- The collection and identification of fruit flies is going on.



### Identification of trapped fruit flies

**Pest Surveillance activities on Fruit fly in Nepal**



Identification seen in orchard



Identification seen in table, RPPL

Following species of fruit flies were found trapped

- Bactrocera dorsalis*
- Bactrocera cucurbitae*
- Bactrocera zonata*
- Bactrocera tau*
- Bactrocera scutellaris*
- Bactrocera yashimotoi*




**Pest Surveillance activities on Fruit fly in Nepal**

## Conclusion

- Fruit fly is one of the major and economic damaged pest of Nepal and found in fruits and vegetables.
- Different types of fruit fly were observed in fruits like pear, grapes, citrus and chestnut and causing severe problems to the Nepalese farmers. Not only fruits but also serious problem in cucurbitaceous vegetables.
- Some activities were accomplished to monitor and manage fruit fly in Nepal. Recently, the surveillance activities were concentrated on quarantine fruit fly species to export Nepalese citrus to China.
- To declare the Pest Free Area is one of the challenge to Nepal to export the citrus to China.
- Nepal has not so strong capacity to diagnose( verification and identification) fruit fly *species*. Thus, it is necessary to maintain a national surveillance system.
- Farmer 's awareness, preparation of pheromone traps and sanitation of the field are the major activities conducted for management of fruit fly in Nepal

**Pest Surveillance activities on Fruit fly in Nepal**

# THANK YOU

