



**Report of Two Months Attachment Program on
Diagnostics of Leafminers and Their
Parasitoids of Agricultural Importance**

at
the Museum Zoologicum Bogoriense, LIPI, Cibinong, Indonesia
15th January to 17th March, 2017

Organized by:



Museum Zoologicum Bogoriense, LIPI

In Collaboration with:



ASEAN Network on Taxonomy

2017



**REPORT OF THE TWO MONTHS ATTACHMENT PROGRAM ON
DIAGNOSTICS OF LEAFMINERS AND THEIR PARASITOIDS OF
AGRICULTURAL IMPORTANCE**

At

Laboratory of Entomology, Division of Zoology, Research Center for Biology

The Indonesian Institute of sciences

Jl. Raya Bogor Km 46 Cibinong, Bogor 16911

January 16~~5~~⁷-March 10~~7~~⁷, 2017

By

Prof. Dr. Rosichon Ubaidillah, Dr. Awit Suwito, Dr. Hari Sutrisno

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The report of the follow up attachment program

At

Laboratory of Entomology, Division of Zoology, Research Center for Biology, The
Indonesian Institute of Science, Bogor-Indonesia

January 15-March 17, 2017

By

Prof. Dr. Rosichon Ubaidillah, Dr. Awit Suwito, Dr. Hari Sutrisno

Background

Leafminers are an immature stage insect that feed on leaf tissues within or between the upper and lower leaves during a part or the whole of their larvae and pupae stages. This larvae could be members of the flies (Diptera), moths (Lepidoptera), beetles (Coleoptera), or sawflies (Hymenoptera). Leafminers attack many species of plants, including vegetable crops, flowering plant, trees and shrubs. Many species of leafminers are important pest in agriculture, especially the diptera and lepidopteran leafminers. The well-known dipteran leafminers pests are belong to the genus of *Liriomyza*, *Phytomyza*, *Chromatomyia* and *Agromyza* (Agromyzidae) which are the most serious pests of horticulture crops, and ornamental plants. In addition, the lepidopteran leafminers often cause serious damage to fruit trees and ornamental plants. The *Phyllocnistis citrae* (Gracillariidae) attacks leaves of citrus plants and inflict a heavy damage on the plants. Apple blotch leafminers (*Phyllonorycter* spp., Gracillariidae), the horse chestnut leafminer (*Cameraria ohridella*, Gracillariidae) and the tea leaf-roller (*Caloptilia theivora*, Gracillariidae; larvae of this species mine leaves during the first three instar stages) are famous as lepidopteran pest leafminers.

Damage by leafminers on horticultural plants is conspicuous in many countries of South-east Asian region. Particularly, several species of *Liriomyza* have invaded since 1990' and become a major pests of vegetable crops such as potatoes, tomatoes, cucumbers, eggplants, lettuce, spinach and legumes. South-East Asian farmers have struggled to control the pests by using insecticides. By common application of insecticides to combat the pest, has become a serious environmental problem, including insecticide resistance, in which most of crops are receiving twice-weekly sprays. In addition, the natural enemies such as parasitoids are also affected by the insecticides sprays. Accordingly, the sustainable management of these pests is a central issue in the field of horticulture and applied entomology. However, it is still difficult to identify the species of *Liriomyza* leafminers because they are polyphagous and their mines are very similar to each other, to say nothing of

larvae. This can delay an effective management of the concerned leafminer. Similar problems could occur in other leafminers.

South-East Asian Workshop on species identification of dipteran and lepidopteran leaf miners and their parasitoid has been done on januray to februari 2016. We trained the 20 participant from 10 South-East Asian countries. The main objective of the course was to understand the taxonomy and ecology of leafminers, as well as to improve their skill on the management of leaf miners. The second objective was to improve the capabilities on collecting samples, preserving and identifying them based on either morphological characters or DNA barcoding. The extension of the course was done to the selected participant of the previous workshop.

Project Training Title:

Training Workshop of THE ATTACHMENT PROGRAM ON DIAGNOSTICS OF LEAFMINERS AND THEIR PARASITOIDS OF AGRICULTURAL IMPORTANCE

Participant:

Mohd Sanusi Mohd Kasim of Assistant Director Plant Biosecurity Division, Department of Agriculture Malaysia.

Team Trainers:

Dr. Awit Suwito (Diptera), Dr. Hari Sutrisno (Lepidoptera=Moths) and Profesor Dr. Rosichon Ubaidillah (Parasitic Wasps). Field Assistant Giyanto and Darmawan (Entomology Technician). Gina Andriyana (Administrator)

Date and Venue:

The training-workshop took place on *16 January – 10 March 2017* at Laboratory of Entomology, Division of Zoology, Research Center for Biology, The Indonesian Institute of Science, Bogor-Indonesia

Objective

The main objective of the training is to develop and strengthen capacity of the participant as an ASEAN Member States (AMS) in taxonomic knowledge to be able accurately to diagnose and identify pests and manage quarantine risks associated with agricultural commodities, especially the leaf miners and their parasitoids

The second objective of the two months attachment program is to several techniques including collecting samples of leafminers on different sites and crops, then how to process and identify them. The participant also learn how to use several keys to identify the leafminer and their parasites. The participant was understand how to recognize some important morphological characters of leaf miners and parasites that has been collected in the field trip.

Content of the Program

a. Lectures and discussions:

Lectures and discussions were given at the beginning of the training before the fieldwork and involved trainers: Prof. Dr. Rosichon, Dr. Awit Suwito, Dr. Hari Sutrisno. The topic of the lectures and discussion as follow:

1. Understanding of Dipteran leaf miners in South East Asia and minor subject lepidopteran leaf miners.
2. Understanding the South East Asian parasitoids of dipteran leafminer,
3. Understanding the use of species identification key and related references for leafminer and their parasitoid.
4. Understanding surveillance technique, sampling and rearing, mounting specimens leafminers and the parasitic wasps that associated with leafminer.
5. Practiced using Dino lite digital microscope for imaging specimen, making scales on the pictures for each magnification and learn how to combine multilayer image using Helicone focus / Combine ZP as well as the editing pictures using Adobe Photoshop,
6. Technical drawing specimens digitally/ konvensional
7. Understanding about the concept of leafminers and their parasitoid management, how seriously they damage horticultural crops, and how to control them appropriately using some potential parasitoid.

b. Fieldwork:

Survey of *Liriomyza* Leafminers and their Parasitoids was done on January 21st-25th, 2017, in Agriculture Production Area Banjenegara - Wonosobo, Central Java, Indonesia. The purpose of the study was to understand the distribution and species composition of *Liriomyza* and their parasitoids population associated with different altitude and vegetable crops. The methodology of the survey were randomized point which focusing on several host plants with gradually altitude from 100 - 2200 meters above sea level. Each site points were observed the presence of leafminers and their parasitic wasp, symptoms and damages, natural enemies, monitoring, and its control measures.

c. Laboratory works:

- a. Rearing of leafminers and parasitoids from infested leaves were collected from fieldworks
- b. Mounting and labelling specimens, and making slide preparations of genitalia.
The participant practicing taxonomic skills in identifying the species of major pest leafminers and their parasite based on the morphological characters.
- c. At the end of the training program, participant presented his experience and the results of training and certification

Outcome

On the whole of the training, the participant receive the useful knowledge and practical experiences on taxonomy and the management of *Liriomyza* leaf miners and their parasitoids in South East Asia. We have trained the new knowledge, learn how to use theory and fieldwork on surveillance technique, sampling and rearing, mounting specimens leafminers and their parasitic wasps. In addition, the participant has been able to identify the species of *Liriomyza* and the parasitic wasps that had been collected from fieldworks. The achievement of the training can be developed by the participant himself in his country in the near future. Several of learning goals has been gotten from the lectures and discussion during the training in laboratory and in the fieldwork. We believe the participant got insight into professional practice in pest management especially in leafminers. However, there are still a lot to discover and improve in the future time. The internship was also good to find out what the strengths and weaknesses are. These help the participant to define what skills and knowledge he has to improve in the coming time.

Field study has resulted 4 species of *Liriomyza* (*L. chinensis*, *L. sativae*, *L. huidobrensis* and *L. trifolii*) and 7 species of parasitic wasp (*Opius chromatomyiae*, *Asecodes deluchii*, *A. Erxias*, *Hemiptarsinus varicornis*, *Gronotoma micromorpha*, *Neocrysocharis okazakii*, *Quadrastichus liriomyza* and *Pediobius metallicus*). The study has shown that those *Liriomyza* and their parasitoids found on several different host plants, including potatoes (*Solanum tuberosum*), Onion (*Alium ampeloprasu*) and Red bean (*Phaseolus vulgaris*). They have been established and could be found from altitude 1147 to 2076 meters, whereas *L. sativae* could be found in lowland area on host plants such as *Phaseolus vulgaris*, *Vigna unguiculota* and *Cucumis sativus* from altitude 113 to 1151 meters above sea level.

Recommendations

It would be more beneficial if the participants were given the equipments that commonly used during the training, so it would be easier for them to develop it in their country.

Acknowledgment

We would like to acknowledge and extend our gratitude thank to JAIF for the financial support to this program. We thanks to Dr. Seotikno.S. Sastroutomo for his help and his arrangement of the training. We also would like to thanks Dr. Witjaksono (the director Center Reserch for Biologi-LIPI) for his support. We sincere gratitude to Gina Andriana, Giyanto, Darwaman, Rina for providing their valuable time and cooperate with us, and without their help this training program would not have been easy to prepare. Moreover, we also thankful to Mohd Sanusi Mohd Kasim (Participant) for his work hard and discipline during attending lectures, discussions, laboratory and fieldwork.

Appendix 1. Schedule training program

Date	Mentor	Mentor
15 Jan 2017 (Sunday)	<ul style="list-style-type: none"> Arrived in Bogor, Jakarta. 	
16 Jan 2017 (Monday)	<ul style="list-style-type: none"> Briefing and orientation. <ul style="list-style-type: none"> Administration, accommodation, transportation and management support. Visit Insect laboratory and Insect Collection 	Ms Gina Andriana Prof Dr Rosichon
17 Jan 2017 (Tuesday)	<ul style="list-style-type: none"> Briefing and discussion of work program for 2 month internship training Introduction of Flies (Diptera), Taxonomy and Morphological Character of Diptera. Collection Method and Dried Specimens 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan
18 Jan 2017 (Wednesday)	<ul style="list-style-type: none"> Study Museum collection Discussion on program of surveillance of leafminers and their parasitic waps 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
19 Jan 2017 (Thursday)	<ul style="list-style-type: none"> Preparation equipment for fieldwork Program survey of liriomyza leafminers and their parasitic waps on 21-23 Jan 2017 in Agriculture Production Area, Banjaneagara-Wonosobo, Central Java. 	Dr Awit Suwito Mr Darmawan Mr Giyanto
20 Jan 2017 (Friday)	<ul style="list-style-type: none"> Depart to Banjaneagara for Program survey of liriomyza leafminers and their parasitic waps. 	Prof Dr Rosichon Dr Awit Suwito
21 Jan 2017 (Saturday)	<ul style="list-style-type: none"> Field work Survey of liriomyza leafminers and their parasitod in Banjaneagara-Wonosobo, Central Java. 	Mr Darmawan Mr Giyanto
22 Jan 2017 (Sunday)	<ul style="list-style-type: none"> Field work Survey of liriomyza leafminers and their parasitod in Banjaneagara-Wonosobo, Central Java. 	
23 Jan 2017 (Monday)	<ul style="list-style-type: none"> Field work Surveillance of liriomyza leafminers and their parasitod in Banjaneagara-Wonosobo, Central Java. 	
24 Jan 2017 (Tuesday)	<ul style="list-style-type: none"> Return to LIPI, Cibinong. 	
25 Jan 2017	<ul style="list-style-type: none"> Preparing laboratory equipments and museum collections 	Dr Awit Suwito

(Wednesday)		Mr Darmawan Mr Giyanto
26 Jan 2017 (Thursday)	<ul style="list-style-type: none"> Laboratory works <ul style="list-style-type: none"> Proses sampling for rearing and record data 	Dr Awit Suwito Mr Darmawan Mr Giyanto
27 Jan 2017 (Friday)	<ul style="list-style-type: none"> Laboratory works <ul style="list-style-type: none"> Observe rearing sample and Sorting sweeping sample 	Dr Awit Suwito Mr Darmawan Mr Giyanto
30Jan 2017 (Monday)	<ul style="list-style-type: none"> Laboratory works <ul style="list-style-type: none"> Observe rearing sample and Sorting sweeping sample 	Dr Awit Suwito Mr Darmawan Mr Giyanto
31 Jan 2017 (Tuesday)	<ul style="list-style-type: none"> Demonstration using Dino lite digital microscope for imaging specimen, Combine multilayer image using Helicone focus / Combine ZP, Editing pictures using Adobe Photoshope, Technical drawing specimens digital/ manual 	Dr Awit Suwito Mr Darmawan
1 Feb 2017 (Wednesday)	<ul style="list-style-type: none"> Laboratory works <ul style="list-style-type: none"> Observe rearing sample and Sorting sweeping sample 	Dr Awit Suwito Mr Darmawan Mr Giyanto
2 Feb 2017 (Thursday)	<ul style="list-style-type: none"> Laboratory works <ul style="list-style-type: none"> Observe rearing sample and Sorting sweeping sample 	
3 Feb 2017 (Friday)	<ul style="list-style-type: none"> Laboratory works <ul style="list-style-type: none"> Observe rearing sample and Sorting sweeping sample Discussion on temporary result on rearing liriomyza and parasitic waps 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
6 Feb 2017 (Monday)	<ul style="list-style-type: none"> Laboratory works <ul style="list-style-type: none"> Observe rearing sample and mounting dried specimen 	Dr Awit Suwito Mr Darmawan Mr Giyanto

7 Feb 2017 (Tuesday)	<ul style="list-style-type: none"> Laboratory works Observe rearing sample and mounting dried specimen 	Dr Awit Suwito Mr Darmawan Mr Giyanto
8 Feb 2017 (Wednesday)	<ul style="list-style-type: none"> Discussion and identification Morphological character of Liriomyza and their parasitod 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
9 Feb 2017 (Thursday)	<ul style="list-style-type: none"> Mounting, labelling and Identification specimens 	Dr Awit Suwito Mr Darmawan Mr Giyanto
10 Feb 2017 (Friday)	<ul style="list-style-type: none"> Mounting, labelling and Identification specimens Preservation and mounting dried specimens using HMDS (1,1,1,3,3,3-HEXAMETHYLDISILAZANE) 	Dr Awit Suwito Mr Darmawan Mr Giyanto
13 Feb 2017 (Monday)	<ul style="list-style-type: none"> Mounting, labelling and Identification specimens Study specimens of liriomyza and parasitic waps morphological character of leafminers and parasitic waps 	Dr Awit Suwito Mr Darmawan Mr Giyanto
14 Feb 2017 (Tuesday)	<ul style="list-style-type: none"> Discussion on temporary result on rearing liriomyza and parasitic waps Identification to liriomyza species and parasitic waps 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
15 Feb 2017 (Wednesday)	<ul style="list-style-type: none"> Study specimens collection Identification to liriomyza species and parasitic waps 	Prof Dr Rosichon Dr Awit Suwito
16 Feb 2017 (Thursday)	<ul style="list-style-type: none"> Study specimens collection Identification to liriomyza species and parasitic waps 	Prof Dr Rosichon Dr Awit Suwito
17 Feb 2017 (Friday)	<ul style="list-style-type: none"> Study specimens collection Identification to liriomyza species and parasitic waps 	Prof Dr Rosichon Dr Awit Suwito
20 Feb 2017 (Monday)	<ul style="list-style-type: none"> Study specimens collection Identification to liriomyza species and parasitic waps Discussion on temporary result on rearing liriomyza and 	Prof Dr Rosichon Dr Awit Suwito

	parasitic waps	Mr Darmawan Mr Giyanto
21 Feb 2017 (Tuesday)	<ul style="list-style-type: none"> • Study specimens collection • Capturing image technique using Dino lite digital 	Dr Awit Suwito Mr Darmawan
22 Feb 2017 (Wednesday)	<ul style="list-style-type: none"> • Study specimens collection • Capturing image technique using Dino lite digital 	Dr Awit Suwito Mr Darmawan
23 Feb 2017 (Thursday)	<ul style="list-style-type: none"> • Study specimens collection • Capturing image technique using Dino lite digital 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
24 Feb 2017 (Friday)	<ul style="list-style-type: none"> • Study specimens collection • Identification to liriomyza species and parasitic waps 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
27 Feb 2017 (Monday)	<ul style="list-style-type: none"> • Discussion and identification of parasitic waps - Pteromalidae, Fitigidae, Eulophidae 	
28 Feb 2017 (Tuesday)	<ul style="list-style-type: none"> • Study specimens collection • Identification to liriomyza species and parasitic waps • Discussion and identification of parasitic waps - Pteromalidae, Fitigidae, Eulophidae 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
1 Mac 2017 (Wednesday)	<ul style="list-style-type: none"> • Study specimens collection • Identification to liriomyza species and parasitic waps • Discussion and identification of parasitic waps - Pteromalidae, Fitigidae, Eulophidae 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
2 Mac 2017 (Thursday)	<ul style="list-style-type: none"> • Study specimens collection • Identification to liriomyza species and parasitic waps • Discussion and identification of parasitic waps - Pteromalidae, Fitigidae, Eulophidae 	Prof Dr Rosichon Dr Awit Suwito Mr Darmawan Mr Giyanto
3 Mac 2017 (Friday)	<ul style="list-style-type: none"> • Discussion on temporary result on rearing liriomyza and parasitic waps 	Prof Dr Rosichon Dr Awit Suwito

6 Mac 2017 (Monday)	<ul style="list-style-type: none"> Data analysis and training report 	Dr Hari Sutrisno. Dr Awit Suwito
7 Mac 2017 (Tuesday)	<ul style="list-style-type: none"> Data analysis and training report 	Dr Hari Sutrisno. Dr Awit Suwito
8 Mac 2017 (Wednesday)	<ul style="list-style-type: none"> Data analysis and training report 	Dr Hari Sutrisno. Dr Awit Suwito
9 Mac 2017 (Thursday)	<ul style="list-style-type: none"> Presentation of the result training at MZB 	Prof Dr Rosichon Dr Awit Suwito
10 Mac 2017 (Friday)	<ul style="list-style-type: none"> Free segment 	

Appendix 2. Activity during THE ATTACHMENT PROGRAM



Prof. Ubaidillah, Dr. Awit Suwito and M. Sanusi are engaged in a heated discussion during lecture and preparation of field activities



Prof. Ubaidillah, Dr. Awit Suwito, M. Sanusi, Giyanto and Darmawan were fieldwork in

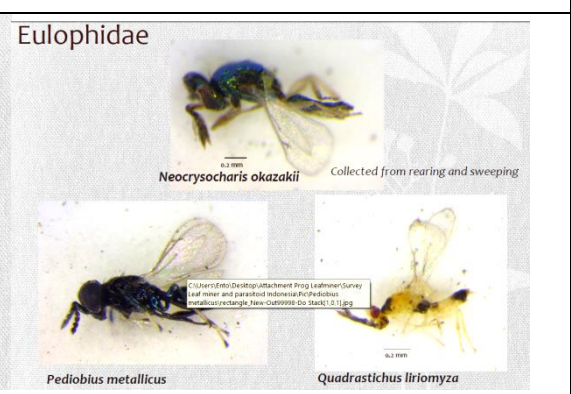
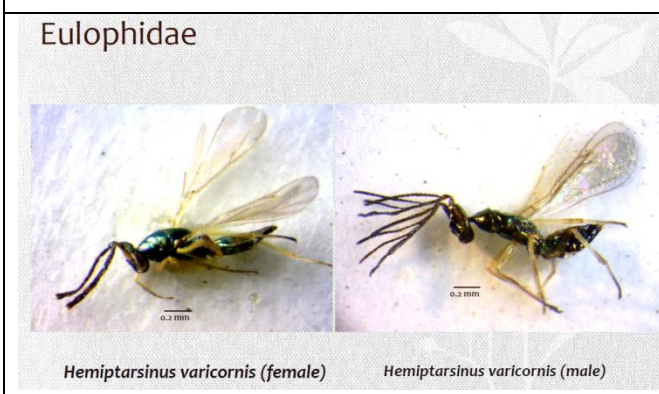
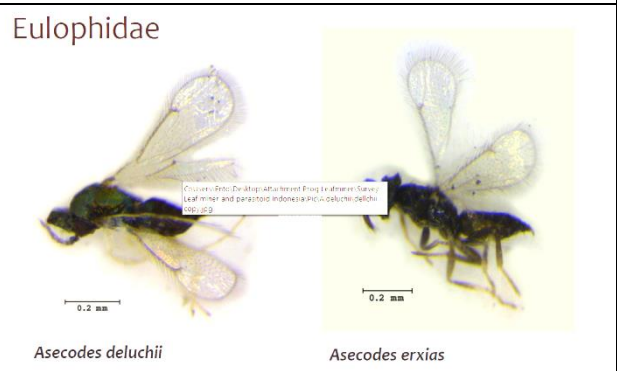
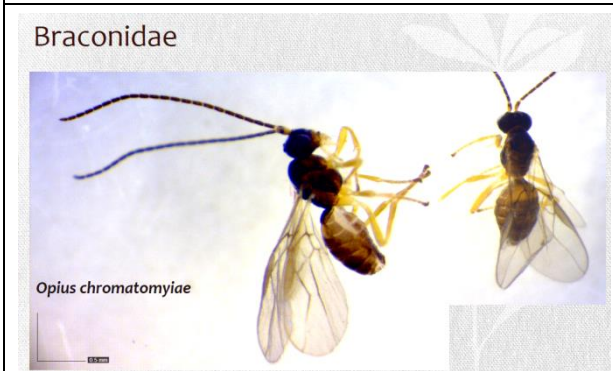
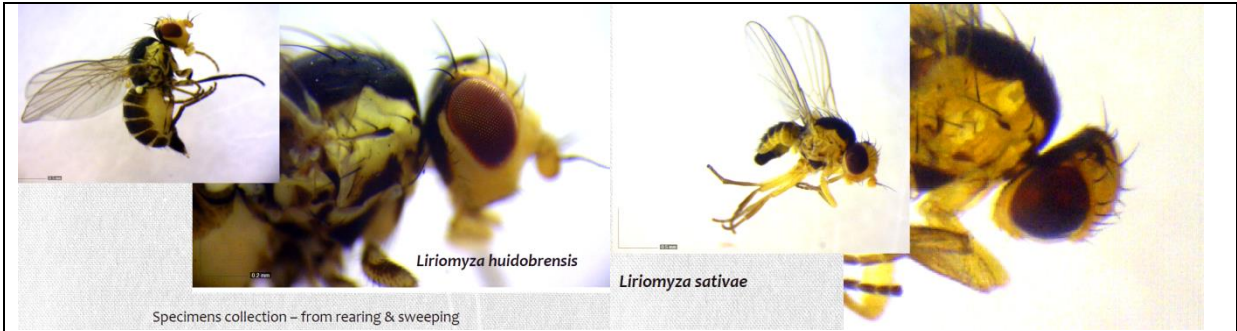
highland of Banjarnegara - Wonosobo, Central Java



Sampling of leafminers and parasitoids in potato gardens and findings many types of pesticides used in the field



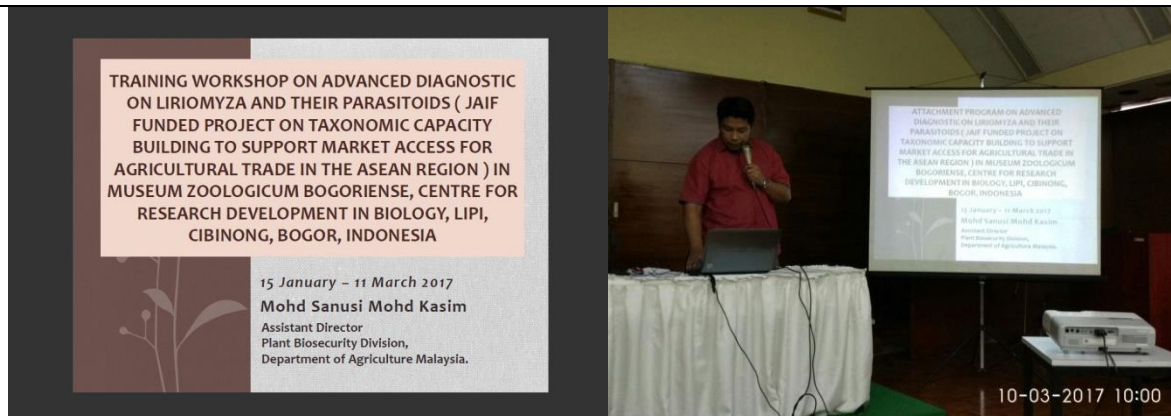
Rearing of various leaves which showed infested symptoms of leafminers and its result preserved in dry specimens



Some image of *Liriomyza* spp. and their parasitoid that emerging from leaves showing symptoms by leafminers .



A moment when Prof. Ubaidillah, Dr.Hari Sutrisno, Dr. Awit Suwito and M. Sanusi together in Entomological Laboratory



The Attachment Program is ended with participant presented his experience and results of the training. Then, finally.....



Certification event.....

We hope this partnership can be continued for the future. Thanks