

**REPORT OF ATTACHMENT PROGRAM
ON WEEVILS OF QUARANTINE
IMPORTANCE WITH SPECIAL EMPHASIS
ON STORED PRODUCT INSECT PESTS**

7th November to 19th December 2018

By

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(Thailand)

Organized by:



Tokyo University of Agriculture
(Tokyo NODAI), Japan

In Collaboration with:



ASEAN Network on Taxonomy

2018

**ATTACHMENT PROGRAM ON WEEVILS OF QUARANTINE IMPORTANCE
WITH SPECIAL EMPHASIS ON STORED PRODUCT INSECT PESTS**

(JAIF Funded Project on Taxonomic Capacity Building to Support Market Access
for Agricultural Trade in the ASEAN Region)

Organizer: Tokyo University of Agriculture (NODAI), Japan

Duration: 7th November to 19th December 2018

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BACKGROUND INFORMATION

The ASEAN Plant Health Cooperation Network (APHCN) – ASEANET Project “Taxonomic capacity building to support market access for agricultural trade in the ASEAN region”, funded by the Japan ASEAN Integration Fund (JAIF) successfully held its capacity building activity, entitled “Training Workshop on Diagnostics of Weevils of Quarantine Importance”, from 10th to 22nd July 2017 at Institute of Weed Science, Entomology and Plant Pathology, University of the Philippines Los Baños, Los Baños, Laguna, Philippines. Based on the recommendation of the resource persons, three participants showed outstanding performance and interest on weevils during the training. These three outstanding participants will be endorsed for the 2nd Phase of the Training Workshop on Diagnostics of Weevils of Quarantine Importance which is a 2-month attachment training program organized by the ASEAN Plant Health Cooperation Network (APHCN) of ASEANET. The three participants will be trained to improve their diagnostic capability and enhance diagnostic resources in the ASEAN. This is also in line with the APHCN-ASEANET project “Taxonomic capacity building to support market access for agricultural trade in the ASEAN region”.

The three selected participants are from Vietnam, Thailand, and Indonesia. During the 1.5-month program, they will be attached to several laboratories in Japan, i.e. Tokyo University of Agriculture (NODAI) Setagaya and Atsugi campuses, and Tsukuba Post-entry Quarantine Centre & Yokohama Plant Protection Research Centre both under the Ministry of Agriculture, Forestry and Fisheries (MAFF). Through this attachment, the participants would be able to gain more in-depth knowledge on taxonomical identification of weevils of quarantine importance, to broaden their diagnostic capability, to increase competency to handle all pest diagnosis, and to widen their experience on weevil collection and preservation. The acquired information would be useful to build up the confidence and skills of the participants thus contributing to capacity development of their Institution or their representative country.

OBJECTIVES OF THE ATTACHMENT

a). To transfer skills and knowledge of weevil experts specifically Japanese experts on Weevils to counterparts in ASEAN countries so as to increase capacity, experience, and knowledge of the participants in the diagnostics of pests and taxonomic identification.

b). To strengthen the diagnostic capacity by providing participants with practical understanding of the concept of weevils, their identification and current management practices, and

c). To tap these selected and trained participants who would undergo more intensive technical training and subsequently serve as potential ASEAN resource persons on the identification of weevils using their gained expertise to the benefit of all ASEAN member states and the ASEAN Diagnostic Network.

PROGRAM OF ATTACHMENT (TIME TABLE)

Date	Activities	Responsible Scientist(s)
Nov 7 (Wed)	Arrival in Tokyo	NODAI staff
Nov 8 (Thurs)	Briefing and Orientation at NODAI	Natsuaki& staff
Nov 9 (Fri)	Visit to Kagaku Miraikan Museum	NODAI staff
Nov 10 (Sat)	Visit to Tama Insect Collection Museum	NODAI staff
Nov 11 (Sun)	Holiday	
Nov 12 (Mon)	Transfer to Yokohama, Introduction to Plant Protection Research Centre and lectures on plant protection in Japan	Mr. Yukio Yokoi Mr. Ren Iwaisumi Ms. Kaori Iwasawa
Nov 13 (Tue)	Morphological characters and lab work on stored product insects (weevil)	Mr. Masami Masumoto
Nov 14 (Wed)	Morphological characters and lab work on stored product insects (weevil)	Mr. Masami Masumoto
Nov 15 (Thurs)	Morphological characters and lab work on stored product insects (moth)	Mr. Yuichi Higo
Nov 16 (Fri)	Morphological characters and lab work on stored product insects (moth)	Mr. Yuichi Higo
Nov 17 (Sat)	Holiday	
Nov 18 (Sun)	Transfer to Kobe	All participants
Nov 19 (Mon)	Orientation, Identification on stored beetles (1)	Mr. Tatsuo Matsuda
Nov 20 (Tue)	Visit warehouse at Kamigumi Co., LTD and Showa Company	Mr. Tatsuo Matsuda
Nov 21 (Wed)	Identification on stored beetles (2)	Mr. Tatsuo Matsuda
Nov 22 (Thurs)	Presentation on the training	Mr. Tatsuo Matsuda
Nov 23 (Fri)	Participants travel to Tokyo	All participants
Nov 24 (Sat)	Visit to Medicinal Plant Garden and Museum of Human Parasites in Meguro	Natsuaki& staff
Nov 25 (Sun)	Free Day	
Nov 26 (Mon)	Move to Tsukuba and visit NARO	Natsuaki& staff
Nov 27 (Tue)	Visit Post-entry Quarantine Centre of MAFF and visit Botanical Garden	Ms. Kaori Iwasawa
Nov 28 (Wed)	Visit Food Research Institute (NARO)	Ms. Kaori Iwasawa Mr. Akihiro Miyanoshita
Nov 29 (Thurs)	Visit Nissan Chemical Industries, LTD.	Natsuaki& staff
Nov 30 (Fri)	Visit ANA-Food Company	Natsuaki& staff
Dec 1 (Sat)	Travel to Tokyo	All participants
Dec 2 (Sun)	Travel to NODAI Atsugi campus	All participants
Dec 3 (Mon)	Introduction of entomology laboratory and its facilities	Kojima & his student

Date	Activities	Responsible Scientist(s)
Dec 4 (Tue)	Weevils systematic and classification - Laboratorywork	Kojima & his student
Dec 5 (Wed)	Visit to Fuji Flavor company	Ishikawa & his student
Dec 6 (Thurs)	Weevils systematic and classification - Laboratory work	Kojima & his student
Dec 7 (Fri)	Weevils systematic and classification - Laboratory work	Kojima & his student
Dec 8 (Sat)	Holiday	
Dec 9 (Sun)	Holiday	
Dec 10 (Mon)	Sorting and observation of other insect taxa	Kojima & his student
Dec 11 (Tue)	Sorting and observation of other insect taxa	Kojima & his student
Dec 12 (Wed)	Visit to Kanagawa Prefecture Museum of Natural History	Kojima & his student
Dec 13 (Thurs)	Preparation for presentations by participants	All participants
Dec 14 (Fri)	Presentations by participants on study at Atsugi campus	All participants & Kojima
Dec 15 (Sat)	Travel to Tokyo	All participants
Dec 16 (Sun)	Rest day	
Dec 17 (Mon)	Preparation for presentation and report writing on the Attachment program in Japan	All participants
Dec 18 (Tue)	Wrap up - Visit to Food and Agriculture Museum and The Research Institute of Evolutionary Biology of Tokyo University of Agriculture	All participants & Natsuaki
Dec 19 (Wed)	Departure of participants	

DAILY ACTIVITIES

8 November 2018 - Tokyo University of Agriculture, Setagaya

I have learnt orientation, University background, Agricultural society, missions also Agricultural situation in Japan. Agricultural Diversification is very important thing to motivate Japan economics which base on improving quality products, processing and services. Moreover, Green tourism is being popular in Japan by attracting young people to be farmer for implanting in Agricultural systems to continue older farmer generation in this country by return man to the farm (Tokyo University of Agriculture, n.d.). However, food safety still is first priority so they focus on organic planting by using biological control (micro parasitism) without chemical control. Although pesticide is toxic but it still be necessary in planting systems so it does not matter if they use it in a right way.

Tokyo NODAI continues to challenge the new “Practical Science” for sustainable development of mankind and the earth follow up Japan Policy “Strong government supports organic planting”.

9 November 2018 – Kagaku Miraikan Museum

Miraikan is a place where we can see a lot of innovations and understand the things happening in our world today from a scientific point of view. In addition to exhibitions that provide people with a chance to enjoy hands-on contact with science and technology. Miraikan museum has 3 parts of knowledge; explore the frontiers, create your future and discover your Earth. We can experience the technological progress of today, to the latest technologies, the global environment, space exploration and life science.(Miraikan, n.d.)

10 November 2018 – Tama Insect Collection Museum

Tama Insect Collection Museum locates on the mountain; it is one part of Tama Zoo. For the insect exhibition, they show a lot of specimen which classified insect to be vary categories; Hall of fame, beneficial and harmful insects, rare and endangered species also migration of insects result from global warming. Moreover, living insect is reared in big dome such as butterflies, aquatic insects, amphibians also insect's behavior demonstration for realize the environmental value. (Tokyo zoo net, n.d.)

12 November 2018 – Yokohama Plant Protection Centre

I studied with Plant Protection Systems in Japan included Introduction, Historical Background. We can improve systems by learning the thing what happened in other countries such as Ireland and France in the past. Finding advantage points of our countries to make our countries be more special or different between other countries belongs to Geographical, Climate and Economy. More focusing on developing Plant Quarantine procedures bases on PRA, IPPC or ISPMs. In the addition, Plant protection law of Japan is very strong so this is mainly reason for successful quarantine systems in Japan. Import-banned plants (not exhaustive) is the most important procedure also inspection statistics (by product) which can be review or look back and prediction any risk in the future. However, other countries can request for sending goods or agricultural products to Japan base on Submit plan, results or review and comment. In the other hand, fruit of food processing are simpler to be export to Japan. For conclusion, knowledge base of other countries requirements is essential factor. Observation laboratory, Nematode, Insect and Pathogen and Living Modified Organism (LMO). We noticed Insect specimens room and its management with standard systems.

13-14 November 2018 – Yokohama Plant Protection Centre

Studied on Coleoptera as injurious stored product pests included domestic and quarantine pests in Japan. Laboratory studies; practiced identify weevils to Family and subfamily by using illustrated Key (Insect and Mite Pests in Food Volume I) and also did dichotomous keys for diagnostic stored product weevil characteristics. This observation emphasized in Family Dermestidae which be important pests of grain and dry foods. Genus *Anthrenus*, *Trogoderma*, *Dermestes* and *Attagenus* were classified by using this key for diagnostic. In the addition, this study can be clearly identifying Kharpa beetle, *Trogoderma granarium* which be quarantine pest in many countries. So we can use this illustrated key to

identify and confirm *Trogoderma* species which intercept at Quarantine station in our countries.

15-16 November 2018 – Yokohama Plant Protection Centre

Studied on Lepidoptera as common stored product pests including domestic and quarantine pests in Japan. Laboratory studies; practiced identify larvae and adults to Family and species by using illustrated Key. This observation emphasized in Family Pyralidae which is important pests of grain and ornamental plants. Larvae in Subfamily Phycitinae, Gelechoidea, Galleriinae, Tineidae and Pyralinae were classified by using this key for diagnostic. Moreover, genitalia observation was observed by dissecting both male and female genitalia for clearly identification. This part is very difficult but more accurately with species confirmation. In the addition, this study can be solved the misidentified problems. So we can use this technique to identify and confirm species both larvae and adults which intercept at Quarantine station in our countries.

19 November 2018 – Kobe Plant Protection Centre

We have learnt about Kobe Plant Protection Station missions included Introduction, Structure of Organization, Administration area which covered West Japan also Hanshin port. A lot of inspection areas belong to Kobe PPS such as port and Rokko Island, port terminal, Kobe airport and 7 branches belong to it. There are so many activities with International Plant Quarantine (Imported and Exported), Domestic Plant Quarantine (seeds, control surveillance and emergency actions) were conducted with quality Quarantine Officers, totally about 200 inspectors are serving. Moreover, procedures comprise with Import quarantine (inspection: refuse or entry, destruction or customer clearance) that emphasize with bananas, oranges and many fruits. Export quarantine procedures shows Phytosanitary requirements (sufficient or not) after that export procedure will determine to be export or impossible to be exported, rice, yam and apple are most exported goods of Japan. However, they always study with Domestic Plant Quarantine base on surveillance, invasive pests and research observations such as fruit flies, moth and weevils.

In the afternoon, observation of stored beetles was noticed in training room that fulfilled with many facilities such as high quality Stereo and Compound microscope also in insect laboratory showed identification methods by morphology and molecular biology. After that Tenebrionidae as stored pests identification was presented by Kobe PPS staff. Both of domestic and quarantine pests of Japan were identified to species by compared specimens with illustrated key and group of important pests specimens. Genus *Tribolium*, *Tenebrio* and *Alphitobius* which be important pests of grain, seeds and flour were classified to species.

20 November 2018 – Warehouse at Kamigumi Co., LTD and Silo at Showa Company

Green bananas, Kiwi and many imported fruits from other countries such as The Philippines and New Zealand were sending and kept in control temperature room at Kamigumi warehouse that is biggest place in this port. Amount of each sampling were

observed by Quarantine Officers. Target pests of this investigation are mealybugs and other sucking insects. Temperature control and sanitary are concerned for warehouse management also fumigation will be taken when quarantine pests were found in each commodity. HCN is chosen for pests eradication with circulated systems with 1-2 hours per round. After that all products will send to the convenience store or supermarket respectively.

Showa Company presented grains processing, marketing and their products which showed that much kind of products such as flour, oil for human and animal feed nutrition. Observe site of Quarantine Officer locates during silo and quayside, after officer investigation all imported goods will send to silo by vacuum line. Wheat, corn, canola and other will be separated for different kind of products. Sanitary is priority for grain container and pathway of production also fumigation management was attached in each silo for clean invasive pests. Other problems and next develop plan of this silo were discussed after company observation.

21 November 2018 – Kobe Plant Protection Centre

A laboratory study of stored beetles was observed again in training room. After that Bruchidae as stored pests identification was presented by Kobe PPS staff. Seed beetles that be domestic and quarantine pests of Japan were identified to species by compared specimens with illustrated key and group of important pests specimens. Genus *Zabrotes*, *Caryedon* and *Callosobruchus* which be important pests of bean and other grains were classified to species. Small examination was tested by identifying different characteristics between 2 specimens which random chosen by lecturer. The results can be classified important characteristics of *Tribolium castaneum* and *Tribolium confusum* that were found to be pest of cosmopolitan and temperate zone, respectively.

In the afternoon, preparation of presentation on both training in Yokohama and Kobe PPS were prepared for result presentation.

22 November 2018 – Kobe Plant Protection Centre

Until preparation of presentation were finished in the late morning after that each participant practiced by individual oral presentation. The title of presentation was divided in 3 parts, firstly was “What have we learned from Tokyo University of Agriculture, Setagaya Campus”, second was “What have we learned from Yokohama Plant Protection Station” and lastly presentation was “What have we learned from Kobe Plant Protection Station” included observation in Kawagumi Warehouse and Showa Company. The presentations were held among Kobe PPS at 1.30 pm. through Yokohama PPS, Tsukuba PPS and MAFF by video conference. Discussion, Q&A and recommended of further study in future were introduced by each station.

24 November 2018 – Medicinal Plant Garden and Museum of Human Parasites in Meguro

This garden plants and rears domestic and exotic plants for medical extraction to be herbal medicines for a long time ago. Green house was taken for contained so many tropical plants from Asian countries. Also in the field domestic plants such as herbs, bulk or perennial plants is planted for use vary parts of plants for diagnosis to find essential and medicinal properties. Surveying and collecting pathogens and insects were noticed on each part of plants. Symptoms from leaves were taken by photos and also collected those to laboratory test. Labeling is important part for collecting in the field.

Museum of Human Parasites shows background research, introduction and the importance of living organism parasites. Some parasites are found in food, water and flesh meat so sanitary and concern about lifestyle risk. In addition, some kind of insects can be vector of extremely diseases such as mosquitoes, lice and bed bugs. So this information will help us know to live and avoid from these parasites. (Atlas obscura, 2019)

26 November 2018 –National Agriculture and Food Research Organization (NARO)

NARO is the institute in Japan for conducting research and development on agriculture and food. Mission is to contribute to the development of society through innovations in agriculture and food, by promoting pioneering and fundamental R&D. All technological developments were conducted to make agriculture a competitive and attractive industry along to R&D to increase the productivity and safety of agriculture and lessen production costs, developing agricultural products, through machines and precision agriculture. Permanent exhibition shows innovations, organic planting, biological agents and agricultural background in Japan until now a day. (NARO, n.d.)

27 November 2018 –Post-entry Quarantine Centre of MAFF and visit Botanical Garden

All post entry suspected goods will be sent from Kobe to Tsukuba PPS especially plant parts which be pathogen while insects and nematode will be transferred to Yokohama PPS and some to Sapporo, Nagoya and OkinawaIsland. Observation symptoms of potato, fruit, apple and sugarcane were taken in several greenhouses by conducted with conditions control and sanitary systems. Biological method starts from inoculations and investigates around 1-2 months until symptoms present or absent. Viruses identification are conducted by Transmission Electron Microscope (TEM) for shape of virus classified after that Serological method (ELIZA) will be observed for virus species identified. Moreover, other facilities of this station be well prepared for diagnostics quarantine pest also domestic pest in Japan. PCR, Real time PCR, PCR Cabinet and Automated Sequencer are always used for solve the post entry problems. All of experimental plants or soil will be discarded and sterile by autoclave technique. The results will always send to other Plant Protection Stations.

In the afternoon, visiting the Tsukuba Botanical garden was taken by MAFF staff. This place was established in 1983 as a botanical research center in the National Museum of

Nature and Science. The mission of this Garden is to investigate and conserve plant diversity, and to raise awareness of the world of plants and its value for our own existence. The World Vegetation Area contains various vegetation from cool-temperate to tropical forests. The area is divided into indoor and outdoor area are the following with permanent exhibitions three greenhouses which showed tropical and subtropical plants, respectively. Around the greenhouses, plants from Japanese temperate are displayed.

28 November 2018 – Food Research Institute (NARO)

Overview of this Division was taken by laboratory observation included control method research such as fumigation, high and low temperature control and CO₂ release. Almost rice, bean chestnuts, herb and dry fruits were conducted with various procedures for eradication base on human sanitary, human dietary and less production costs as well. Stored product pests are reared in optimize temperature for each such as *Tribolium confusum*, *Callosobruchus chinensis*, *Sitotoga cerealella* etc. Mass rearing and insect preparation room are completely divided for contamination concern. Moreover, pheromone traps are attached for insect invasion monitoring inside of this building for immediately management. Fumigation researches are multiplied so many times for precision results same as above. Stored product insects are always identified by Morphology and also Molecular Biology.

In the afternoon, products and packaging were discussed by compared old package and new package. In the addition, stored product pest preference research are taken by using varies insect stages; larvae, pupae and adults for solve the contamination problem of product packages. The results show larvae stage is more serious problems more than other stages. Although, adults can be attacked some products but wrapping film, screw and tightness improvement can be reduced infestation and contamination as well.

29 November 2018 – Visit Nissan Chemical Industries, LTD.

The company factory has taken research about Biological, Chemical and Materials for a long time. Residual analysis is emphasized among Herbicide, Fungicide, Pesticide and side effect with water living organism and environmental concern. Company presentations showed introduction, Background, organization, research and development. A lot of facilities conducted with research division in each laboratory and greenhouse examination. For example, herbicide was observed between weeds and crop plants such as rice, wheat, corn and others for optimize concentration also fungicide. Big chambers are used to stimulated fungi development and tested with antagonist agents. In the addition, greenhouse management is maintained with a lot of workers and data collected were recorded for estimated the final results for created suitable pesticide in each plantation geographical. Moreover, materials research was always developed to modern agriculture for faster and less production costs such as automatic planting, fertilizers and condition controller. Insect laboratory showed us to know how to reared economic insect pests such as diamond black moth, brown plant hopper and also western flower thrips. Each control method; dipping, absorbing and predatory mites was showed by moth larvae, plant hopper nymph and mites experimental, respectively. In

conclusion, this company aims to reduce product residue among research and developments for empower in the world. (Nissan Chemical Cooperation, 2018)

30 November 2018 – Visit ANA-Foods Company

This company presented history, business and their products since established in Japan 60 years ago. Banana business was first imported from Taiwan but now a day, The Philippines is mainly country for green bananas imported. In addition, the import of other fresh fruits and vegetables such as grapefruit, as well as food ingredients from around the world such as walnuts, raisins, and prunes, which sell to major food manufacturers and other buyers. Although, they imported a lot of green bananas from many countries but chamber conditions and packing were always developed and explored for finding optimize conditions in case of stage of bananas and market demand. More than 30 procedures were adapted base on bananas varieties and other factors of imported products by computers, maximum and minimum temperature, banana respiration, humidity and CO₂ data were collected and recorded for solved next unexpected problems. (ANA, n.d.)

3 December 2018 – Tokyo University of Agriculture, Atsugi Campus

Firstly, orientation, laboratory and other facilities were introduced to participants. Insect collection, stereo microscope, scientific images were demonstrated during insect specimen management explained. Economic pests especially weevils were shown from each by each drawer moreover thrips and important pest that participants interested were also discussed. NODAI Entomology Laboratory located on 2nd and 3rd floor, some students have done those researches in molecular biological room and SEM as well. Surveying weevils started in the late afternoon, some trees and other hosts were mentioned to be weevils host plants. Greenhouse showed temperate plantation also another greenhouse was planted tropical plants. Those plants were described about weevil habitats and how to find them in each part of plants.

In the afternoon, training activities in Los Banos, The Philippines were reviewed by discussion and compared with lecturer lessons. A lot of information was tough through presentation and textbooks such as weevil databases, common illustrated key and systematic of weevil. After that participants practiced to identify weevils from Malaysia from Family to subfamily. The correction was taken and also discussion about important characteristics of each subfamily and tribe as well.

4 December 2018 – Tokyo University of Agriculture, Atsugi Campus

All participants continued practice to identify weevils from Malaysia from Family to subfamily. The important characteristics of each subfamily were identified to be subfamily Entiminae, Curculioninae, Conoderinae, Baridinae, Lixinae, Cossoninae, Errhininae, Molytinae and Cryptorhynchinae. Tribe of important weevil was basically mentioned.

5 December 2018 – Visiting Fuji Flavor Company

This company presented monitoring is a key component of integrated pest management (IPM). Fuji Flavor Co., Ltd has been developed an excellent pheromone trap to be quality products more than 30 years. Moreover, "ECOMONE" Division is the first company to launch pheromone trap for monitoring the tobacco beetle, the most harmful insect of tobacco. A lot of their products have been used in the food, pharmaceutical and warehousing industries. They continue to develop new monitoring devices that meet the demands of customers with research institutes and universities around the world. Furthermore, they will continue to endeavor to fully satisfy future customer needs. SERRICO, NEW SERRICO, GACHON and TORIOS are well known and popular in many countries. Although, those cannot eradicate stored pest but this is the monitoring methods and making a discussion of control or other managements. Less chemical, more specific with insect pests, enable to capture target by using sex pheromone also food attractant. Production line were showed about how to prepare pheromone trap such as pheromone injection, packaging, labelling and air leak checking. Sanitary and contamination are always concerned about those. In addition, Entomology research division tries to develop other techniques; insect mass rearing (13 beetles and 5 moths species), 6 breeding chambers which use different conditions, varies size of boxes for experiment between insect behavior and their preference. Furthermore, their entomologist always observes with store products biology, ecology and morphology as well. In conclusion, they can reduce amount of pheromone using per unit, the characteristic of cigarette beetle and red flour beetle were described. (Fuji Flavor Co., Ltd, n.d.)

6 December 2018 – Tokyo University of Agriculture, Atsugi Campus

Tribe of quarantine weevil that always intercepted at other quarantine stations and important characteristics of subfamily Entiminae, Molytinae and Cryptorhynchinae were described. The observations were taken by participants.

7 December 2018 – Tokyo University of Agriculture, Atsugi Campus

Characteristics of weevil in subfamily Errhininae and rice water weevil were described. The observations were taken by participants.

10 December 2018 – Tokyo University of Agriculture, Atsugi Campus

In the morning, participants concentrated with illustrated key and identified weevils from Vietnam from Family to subfamily. The correction was taken and also discussion about important characteristics of each subfamily and tribe as well. After that, important of weevil were discussed among lecturer and participants about pests, pollinator and biological agents.

Insect collection methods and basic tools were showed to know some tips and techniques in field trips.

11 December 2018 – Tokyo University of Agriculture, Atsugi Campus

All participants continued identified weevils from Vietnam from Family to subfamily. The important characteristics of each subfamily were identified to be subfamily Entiminae, Curculioninae, Baridinae, Molytinae and Cryptorhynchinae. Some specimens were observed to be Family Anthribidae, Apionidae and Attelabidae. Tribes of important weevil were classified. In the afternoon, all participants practiced to use SEM and scientific photos were taken.

12 December 2018 – Visit to Kanagawa Prefecture Museum of Natural History

The Museum was established in March 1995. In addition to the exhibitions, the Museum conducts such work as survey and research on nature, and material collection and preservation. Utilizing these, it also carries out study support activities like lecture courses, observation sessions, etc. Regular Exhibition, The Earth's history. The Exhibition presents over 10,000 pieces of real specimens, ranging from skeletons of gargantuan dinosaurs or meteors to tiny insects. (Kanagawa Prefecture Museum of Natural History, 2006)

13 December 2018 – Tokyo University of Agriculture, Atsugi Campus

Discussion and preparation for presentations by participants

14 December 2018 – Tokyo University of Agriculture, Atsugi Campus

Presentations by participants on study at Atsugi campus – The title of presentation was “What have we learned from Tokyo University of Agriculture, Atsugi campus” which comprised with weevils identification, systematic, ecology and laboratory works. In addition, the results of other visiting (Fuji Flavor and Kanagawa Museum of National History) were also presented.

17 December 2018 – Tokyo University of Agriculture, Setagaya

Final presentation on the Attachment program in Japan – All information of this training were divided in 3 parts and presented by each participant (“What have we learned from Tokyo University of Agriculture, Setagaya and Atsugi campus”, Japan Plant Protection Procedure and Companies visiting. For me, the title of my final presentation was separated to two sections. First is introduction of my responsibilities in Department of Agriculture, Bangkok, Thailand and plant protection procedure in my country. Second is “What have we learned from Tokyo University of Agriculture, Setagaya and Atsugi campus” which included with the objective and policy of Setagaya campus and weevil identification, the important quarantine weevils and laboratory works of Atsugi campus. After that Q&A were discussed between NODAI staff and under graduated student.

18 December 2018 – Visit to Food and Agriculture Museum and the Research Institute of Evolutionary Biology

Wrapped up and visited to Food and Agriculture Museum to study the research of post harvest product which can be processed and developed to nutrient food and good for human health such as extracts from many herbals and rice that belongs to breeding and improvement varieties. Moreover, we have learnt pig, chicken and sage history which showed on second floor of this building.

In the afternoon, we have visited to insect museum of the Research Institute of Evolutionary Biology. Lepidopterist curator explained the mission of this museum included with insect identification, rare and endanger species research. A lot of quarantine weevils, moths and butterflies specimens were showed and discussed between him and all participants. Moreover, the insect museum management of each countries were shared and discussed so we can applied some methods in our countries.

19 December 2018 – Tokyo University of Agriculture, Setagaya

Departure of participants

SUMMARY OF THE ATTACHMENT

Attachment Program on Weevils of Quarantine Importance with Special Emphasis on Stored Product Insect Pests was taken in several laboratories in Japan from 7 November to 19 December 2018.

Firstly, the training on weevils identification was learnt in Nodai Entomology Laboratory (Tokyo University of Agriculture, Atsugi campus. Orientation, important quarantine weevils, pest status, their host plants and ecology were described. All participants have practiced to identify a lot of quarantine weevils from several countries. The important morphology of each subfamily was noticed and compared with illustrated key. The important characteristics of Family Curculionidae was identified to be subfamily Entiminae, Curculioninae, Baridinae, Molytinae, Errhininae, Lixinae and Cryptorhynchinae. Some specimens were observed to be Family Anthribidae, Apionidae and Attelabidae. Moreover, these intensive laboratory practiced help us to strengthen our identification skill and confidence. A lot of weevils database information were suggested through participants such as weevil databases website, common illustrated key and systematic of weevil. Finally, these observations can be used and trained to other quarantine officers who have work in the Quarantine Station along country borders to accuracy classified important quarantine weevils and confirmed the result with international trade countries.

During visiting insect collection in NODAI and other museums we have observed the collection maintenance such as insect preservation belongs to international standard, room temperature and humidity control, injurious and important quarantine pests, other facilities for specimen management (high resolution stereo microscope, transmission electron microscope and molecular biology laboratory). Those can be applied to maintain insect

collection in our countries. In addition, surveying techniques and collecting insect methods in field were shown by each curator who has worked in several insect collections for developing and fulfilled insect collecting skills in our countries.

Japan Quarantine Procedure were shown the partway of Japan quarantine systems which belong to Ministry of Agriculture, Forestry and Fisheries (MAFF). Each Plant Protection Station; Yokohama, Kobe and Tsukuba Post entry Station has different task to suspect and manage imported products from other countries such as insect especially weevils and stored product insect, pathogen, Living Modified Organism (LMO) and post entry product testing in greenhouse. For example, Yokohama PPS has concentrated with weevils and pathogens while Kobe PPS has inspected imported products along several ports in Kobe and Tsukuba PPS has done laboratory research in greenhouse after they received products suspect from Kobe PPS and other Plant Protection Station from several areas in Japan. For laboratory studied we have known the important characteristics of stored products weevil and those were identified to be Family Dermestidae (*Trogoderma granarium*, *Trogoderma* sp.), Tenebrionidae (*Tribolium confusum*, *Tribolium* sp.), Bruchidae (*Callosobruchus* sp.). Furthermore, Plant Quarantine procedures in Japan is very strong bases on PRA, IPPC or ISPMs so this is mainly reason for successful quarantine systems in Japan.

All Bio-based companies have shown about history, business, production line and their products since established in Japan so many years ago. Sanitary and environmental effects (residue, pesticide using and toxicity) are always concerned about those. Moreover, materials research was always developed to modern agricultural for faster and less production costs. All data were collected and recorded for solved next unexpected problems. The results of that can be made valuable products for markets and save for consumers.

The summary of this attachment, we have gained more in-depth knowledge on taxonomical identification of weevils of quarantine importance, to broaden our diagnostic capability, to increase competency to handle all pest diagnosis, and can be widen our experience on weevil collection and preservation. The acquired information can be useful to build up the confidence and skills of the participants thus contributing to capacity development of their Institution or their representative country. Furthermore, this knowledge will be shared with other colleagues in our workplace and quarantine officer who works in border region of our countries. Diagnostics and taxonomic will be held for train young generation staff to increase capacity also strengthen diagnostic capacity. In conclusion, we have had network for work or research cooperation between our countries and Japan as well.

RECOMMENDATION FROM THE ATTACHMENT PROGRAM

This training was relevant with my task in Thailand. Moreover, I am very happy because I am the one of 3 participants who is insect taxonomist so this training is more familiar to me than other participants. For other participants, it seems unfamiliar laboratory work about weevil identification so they have to take a lot of times for understanding. So that means if participants have graduated in Entomology are better than participants who have

graduated in other courses. However, we can practice these skills that we learnt from each weevils experts in university and plant protection station. I was appreciated to be one of participants in this training. I can strengthen my weevil identification skills during I had been in several laboratories in Japan. Furthermore, I can have a weevil identification network with Japanese experts and Asian countries.

RECOMMENDATION FOR FUTURE ACTIVITIES

Aphid and thrips are very important pest; it also be insect vector of viruses which be injurious pathogens in many countries. Moreover, those have a lot of species and they can feed a lot of plants. So aphids and thrips identification that are quarantine pest should be taken for training in one or two week in Asian countries. This include introduction and slide preparation for identification. This training can be completed with clearly identification, biology and its host plants.

ACKNOWLEDGEMENTS

I would like to express the appreciation to The ASEAN Plant Health Cooperation Network (APHCN) – ASEANET Project “Taxonomic capacity building to support market access for agricultural trade in the ASEAN region”, funded by the Japan ASEAN Integration Fund (JAIF) which continually held capacity building activity for Asian countries since training workshop in Los Banos, The Philippines from 10th to 22nd July 2017 and also resource person during intensive training.

I would like to thank you Dr. Keiko Natsuaki, Professor, Tokyo University of Agriculture (NODAI) Setagaya, and other staff whose kindly manage and their hospitalities during our training in Japan. In addition, a thank you to Dr. Soetikno Sastroutomo, who cooperated this training from last year until successfully completed.

Finally, I would like to thank you to Yokohama Plant Protection Station, Kobe Plant Protection Station, Tsukuba Post-entry Quarantine Centre, all under the Ministry of Agriculture, Forestry and Fisheries (MAFF), their staff and other companies whose hearty teach and transfer a lot of information during this training in Japan.

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Annexes/Attachment

Presentations by Resource Persons

1. Matsuda, T. 19 November 2018. Overview of MAFF Kobe Plant Protection Station. Kobe PPS Conference room. MAFF Kobe Plant Protection Station.
2. Yokoi, Y. 12 November 2018. Plant Protection System in Japan. Yokohama Plant Protection Station. MAFF. Japan

Manual (Received from resource persons for free)

From Mr. Tatsuo Matsuda, Deputy Chief Identifier, Kobe PPS

1. Gorham, J.R. 1991. Insect and Mite Pests in Food. An Illustrated Key Volume 1. Washington, DC. USA. (Adult and Laval Beetles, Dermestid Beetles, Darkling Beetles, Seed Beetles, Spider Beetles)

From Mr. Yuichi Higo, Quarantine officer, Yokohama PPS

1. Brambila, J. 2009. Steps for the dissection of male *Spodoptera* moths (Lepidoptera: Noctuidae) and notes on distinguishing *S. litura* and *S. littoralis* from native *Spodoptera* species. USDA-APHIS-PPQ.
2. Diagnosis *Holicoverpaarmigera* (Adult and larva)
3. Higo, Y. 2018. Common Insect Pests of Stored Food Products-A Guide to their Identification Lepidoptera-. Entomology and Nematology Section, Research Division, Yokohama Plant Protection Station.

From Prof. Hiroaki Kijima, Tokyo University of Agriculture, Astugi campus

1. Morris, M.G. 2002. True Weevils (Part I) Coleoptera: Curculionidae (Subfamilies Raymondionyminae to Smicronychinae. ROYAL ENTOMOLOGICAL

- SOCIETY and the FIELD STUDIES COUNCIL. London. England.
2. Morimoto, K. 1972. A Key to the Genera of Oriental Anthribidae. Bulletin of the Government Forest Experiment Station. Tokyo. Japan.
 3. Yoshitakae, H. 2071. Habitus Identification of Weevils.
 4. Kojima, H. 2018. Introduction of Weevils and their Identification Primer.

Lecture Notes

1. Research activities by Entomology Section (Yokohama PPS)
2. Checklist of families of Coleoptera as stored pest (Yokohama PPS)
3. Stored pest lists was intercepted in Kobe PPS

Presentation by Participants

1. “What have we learned from Tokyo University of Agriculture, Setagaya Campus, Yokohama and Kobe PPS” included observation in Kawagumi Warehouse and Showa Company presented on 22 November 2018 at Kobe Plant Protection Centre
2. “What have we learned from Tokyo University of Agriculture, Atsugi campus” and companies visiting (Fuji Flavor and Kanagawa Museum of National History) presented on 14 December 2018 at Tokyo University of Agriculture, Atsugi campus
3. “Introduction of my responsibilities in Department of Agriculture, Bangkok, Thailand and “What have we learned from Tokyo University of Agriculture, Setagaya and Atsugi campus presented on 17 December 2018 at Tokyo University of Agriculture, Setagaya campus

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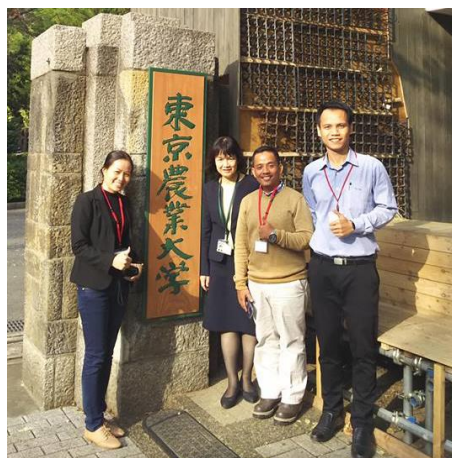
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List of Figures/Images/Photos:



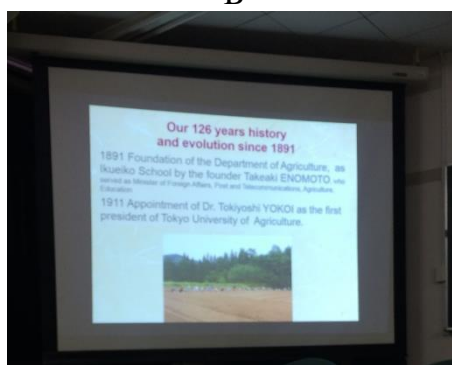
A



B



C



D



E



F

Figure 1 Briefing and Orientation at NODAI(8 November 2018)

- A. History of Tokyo University of Agriculture
- B. Group Photo with NODAI Vice President (Prof. Keiko Natsuaki)
- C. Visited NODAI Library building
- D. Lecture about University objective and policy
- E. Biological Agents, fungicide and predatory mites
- F. Visited Botanical garden of NODAI

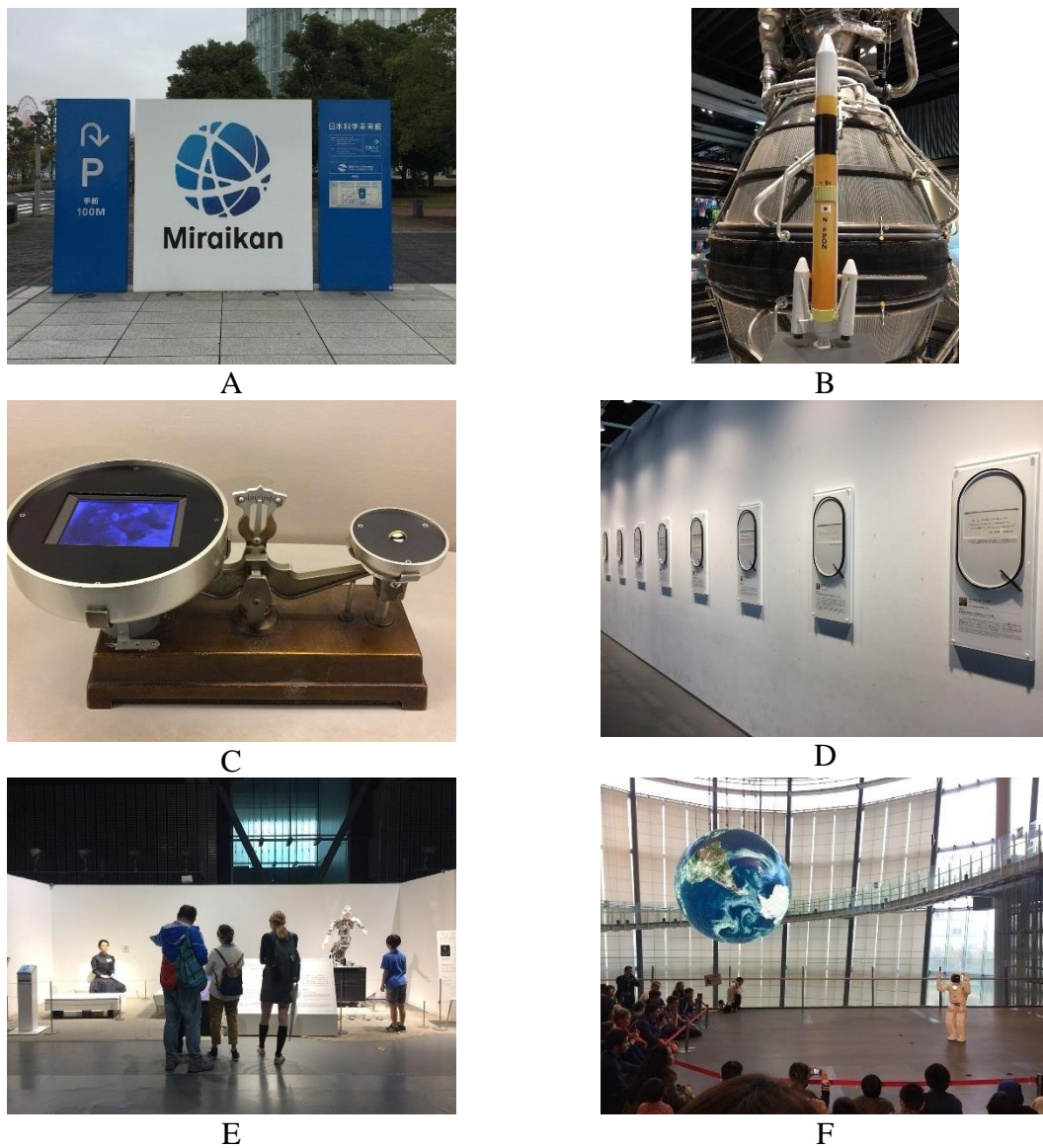


Figure 2 Visit to Kagaku Miraikan Museum (9 November 2018)

- A. Visited Miraikan Museum
- B. Aerospace exhibition
- C. Environmental concern exhibition
- D. Question and answer interaction
- E. Artificial Intelligent and Robot exhibition
- F. ASIMO Showtime



Figure 3 Visit to Tama Insect Collection Museum (10 November 2018)

- A. Visited Tama Zoo
- B. Metamorphosis of insect
- C. Living insect exhibition
- D. Insectarium of Tama Zoo
- E. Insect diversity exhibition
- F. Insect Hall of fame



Figure 4 Yokohama Plant Protection Station (12 November 2018)

- A. Introduction and History of Plant Protection Station in Japan
- B. Introduction and mission of Yokohama PPS
- C. Observed quarantine pests which intercepted in Yokohama PPS
- D. Visited in insect specimen room (*Trogoderma granarium*)
- E. Participants practiced to identify injurious pest
- F. Observed domestic pest in Japan

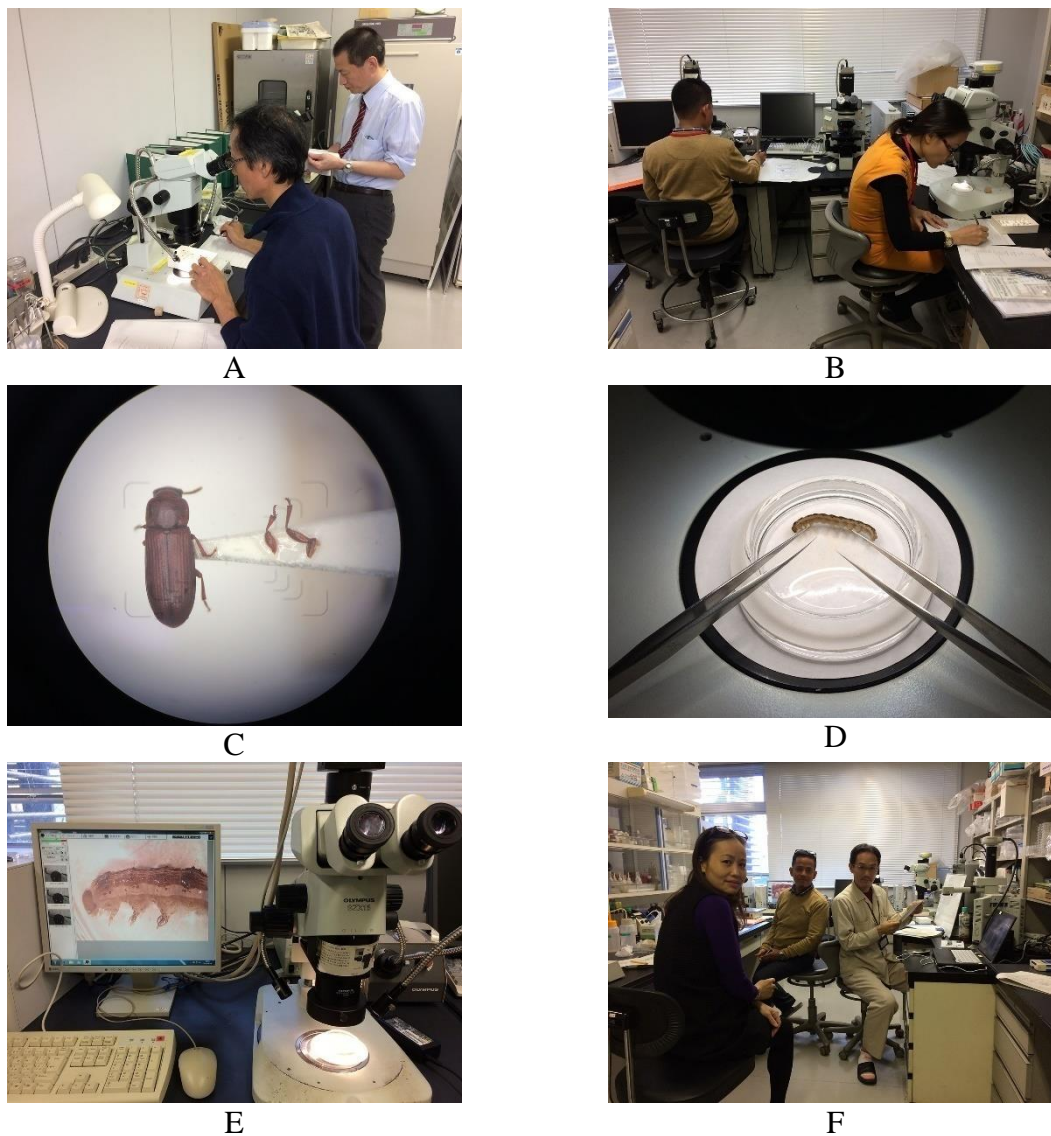


Figure 5 Morphological characters and lab work on stored product insects at Yokohama Plant Protection Station (13-16 November 2018)

- A. The results of identification were corrected by Yokohama PPS staff
- B. Participants practiced to identify stored product insect by using illustrated keys
- C. Red flour beetle was settled by showing the different of tarsi on midleg and hindleg
- D. Practiced to identify caterpillar which be injurious pest
- E. Morphological characteristic was captured for writing report and journal
- F. Group photo with lepidopterist expert



Figure 6 Identification on stored beetles at Kobe Plant Protection Station
(19, 21-22 November 2018)

- A. Presentation of stored product identification by Kobe PPS staff
- B. Lab work on important stored product identification
- C. *Tribolium confusum* observation
- D. Practiced to identify quarantine stored product of Japan
- E. Visited in Insect specimen room of Kobe PPS
- F. Specimens and illustrated key were used to explain though all participants



Figure 7 Visit Warehouse at Kamigumi Co., LTD (20 November 2018)

- A. Quarantine officers inspected kiwi fruits which imported from New Zealand
- B. Quarantine officers inspected bananas which imported from The Philippines
- C. Sampling imported products were intensive investigated
- D. Explanation of fumigation systems and management



Figure 8 Visit Showa Company (20 November 2018)

- A. VDO presentation about introduction, product and market plan of Showa Company New Zealand
- B. Showa staff showed how to collected grain or seed for processing
- C. Discussion about how to fumigated grain or seed when stored product were found
- D. Uniform for protected flour or other dust during visiting in silo



A



B



C



D



E



F

Figure 9 Visit to Medicinal Plant Garden and Museum of Human Parasites in Meguro
(24 November 2018)

A. Prof. Keiko showed how to noticed symptom and collected part of plant for identification in laboratory

B-E. Several tropical plants have planted for medicinal analysis

F. Important human parasites; flea, lice and mosquito



Figure 10 Visit to National Agriculture and Food Research Organization, Tsukuba (26 November 2018)

- A. Visited NARO and exhibition hall
- B. NARO staff presented organization objective and showed successful research
- C. A lot of organic products were displayed by environment concern concept
- D. Flightless ladybird research was shown why did it can be successful used
- E. Silkworm breeding was developed for various color
- F. Silk which developed by varieties selection can be glowed with UV light

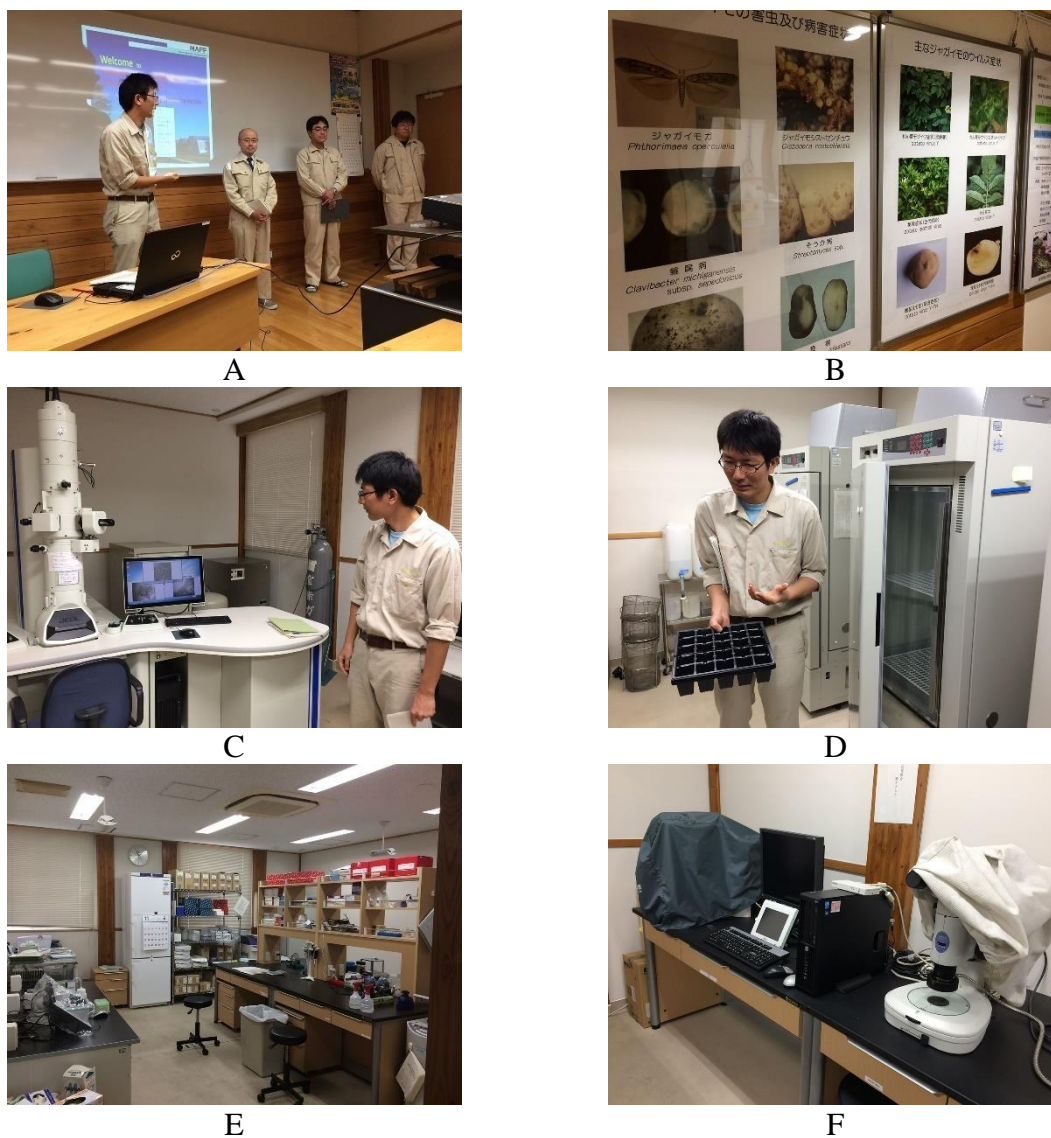


Figure 11 Visit to Tsukuba Center Post-entry Quarantine Centre of MAFF
(27 November 2018)

A. Introduced of Tsukuba PPS staff and showed presentation

B. Poster previewed some post entry products investigated

C-F. Tsukuba PPS staff showed laboratory facilities for pest detected

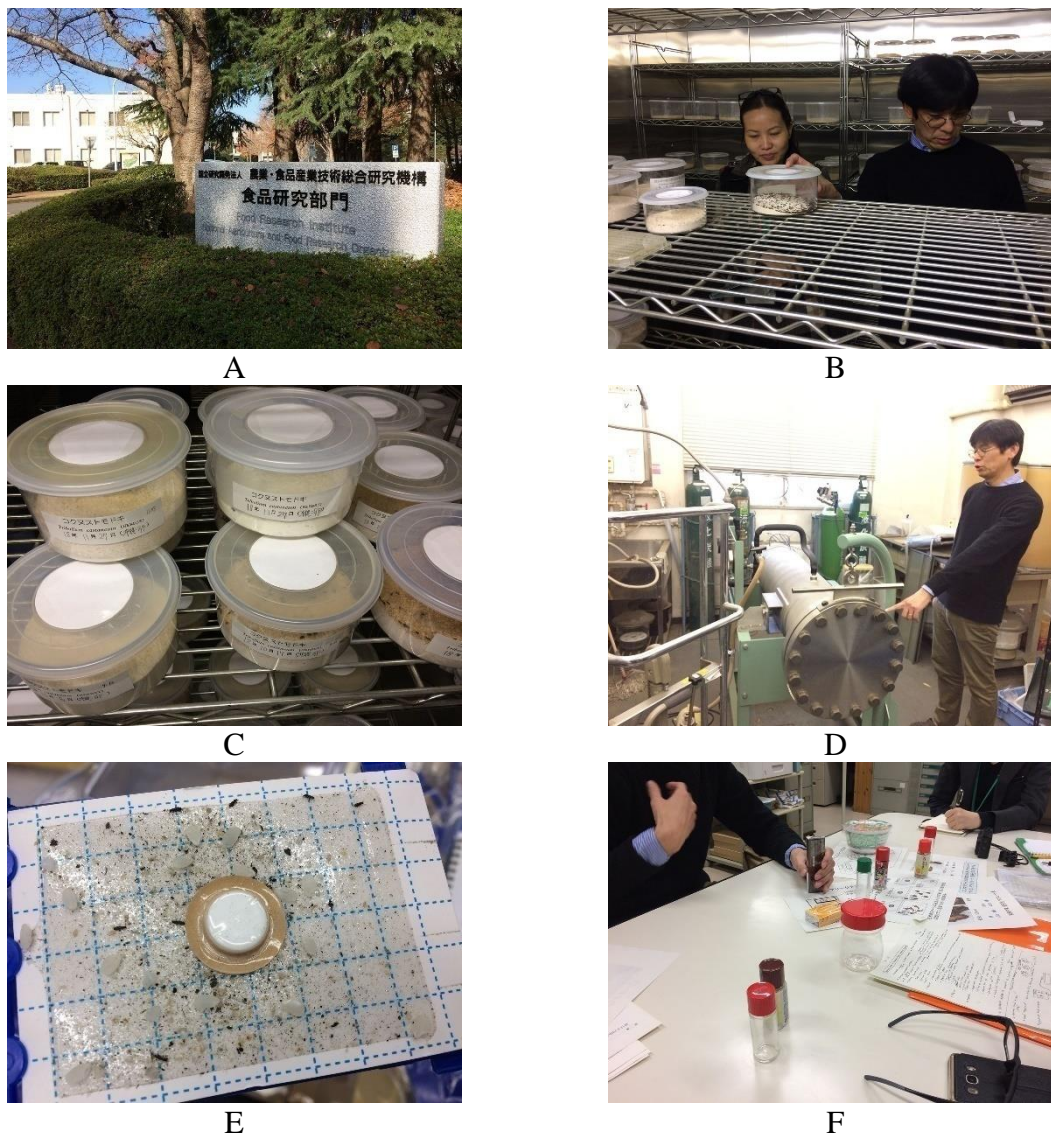


Figure 12 Visit Food Research Institute (NARO) (28 November 2018)

- A. Food Research Institute of NARO
- B. NARO staff explained about mass rearing room condition and management
- C. Stock of stored products were prepared for using in control testing
- D. Testing material for using high pressure with CO₂ against stored product insects
- E. Pheromone trap was used to stored product insects monitoring
- F. Discussion about packaging development for protect stored product insects which concerned by consumer sanitary

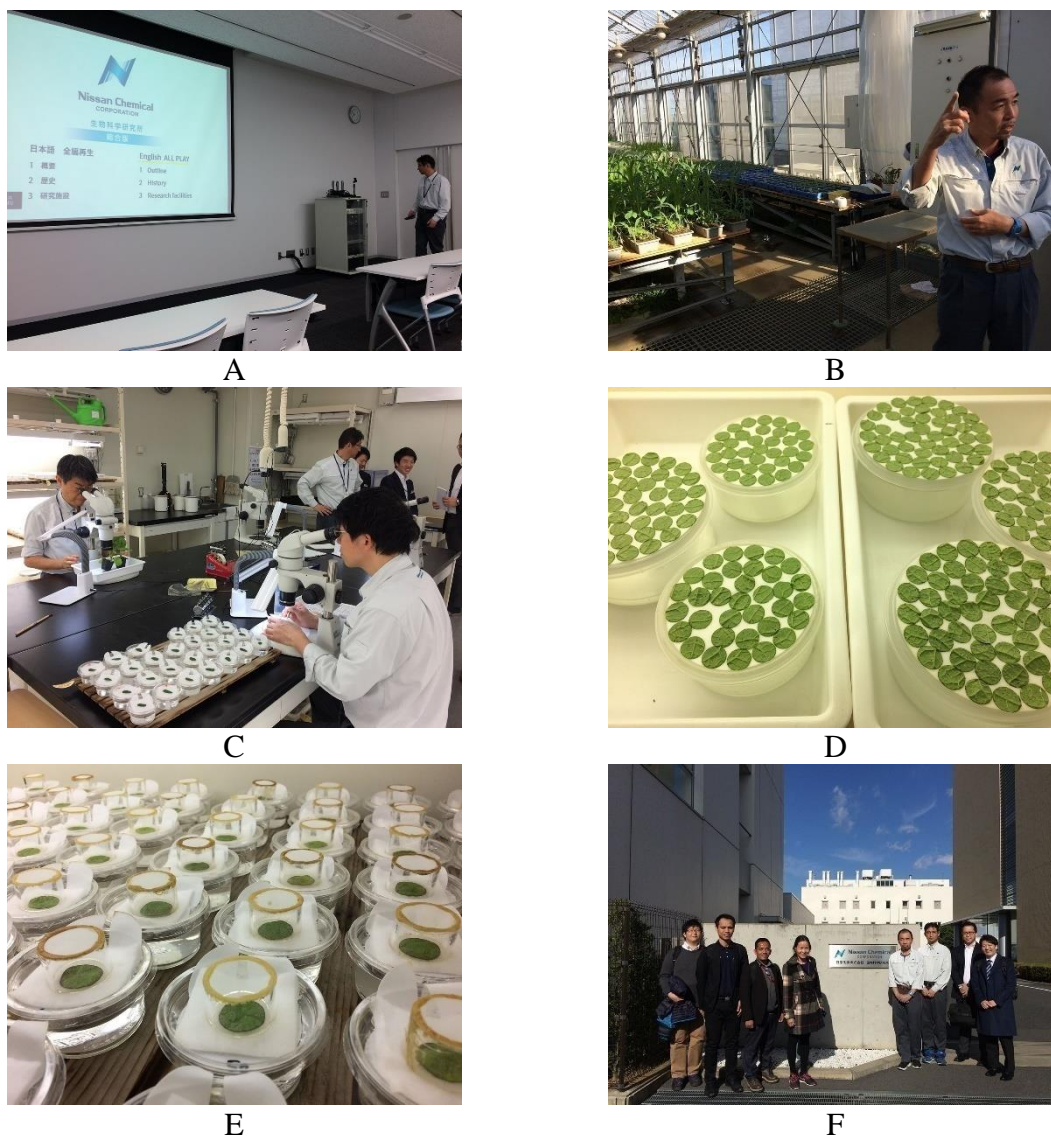


Figure 13 Visit to Nissan Chemical Industries, LTD. (29 November 2018)

- A. Presentation showed background company and their researches
- B. Field laboratory was used for selecting suitable conditions of plant protection with other treatments
- C. Insect mass rearing and laboratory, officer checked the results of mortality and longevity of insects
- D. A lot of mites were treated and selected for chemical testing
- E. Western flowerthrips were treated for chemical testing
- F. Group photo of all participants and Nissan Chemical officers

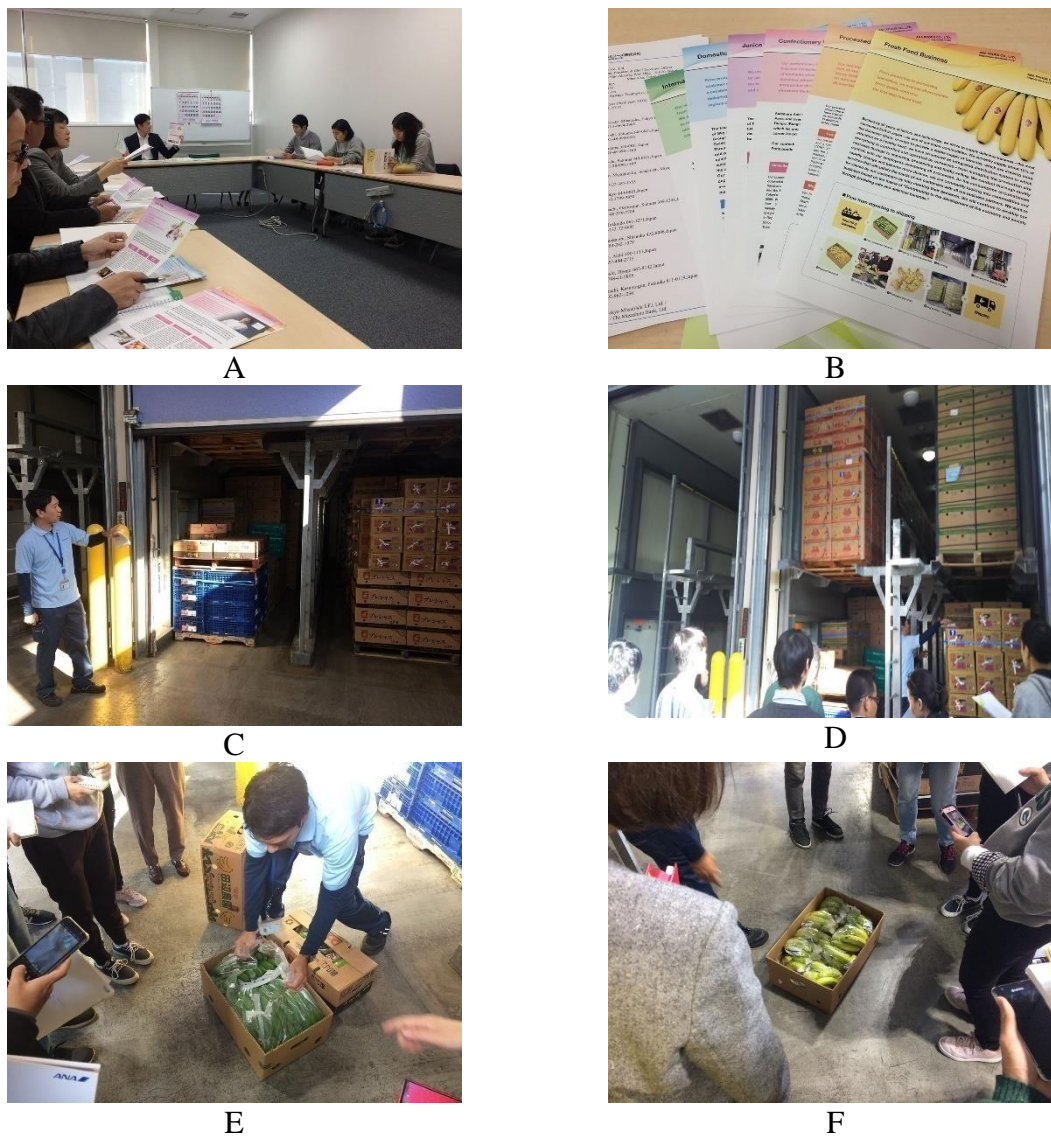


Figure 14 Visit to ANA-Food Company (30 November 2018)

- A. Briefly introduction and background company and them imported business
- B. Boucher of products and company researches in Japan
- C. ANA-Food staff explained how to control the condition for banana ripening
- D. Packaging of each company was maintained for easily ventilation with ethylene until completely ripening
- E. Each package was checked for preparing and keeping in chamber
- F. Banana qualities were checked after the end of ripening process, some damaged banana fruits were removed from boxes

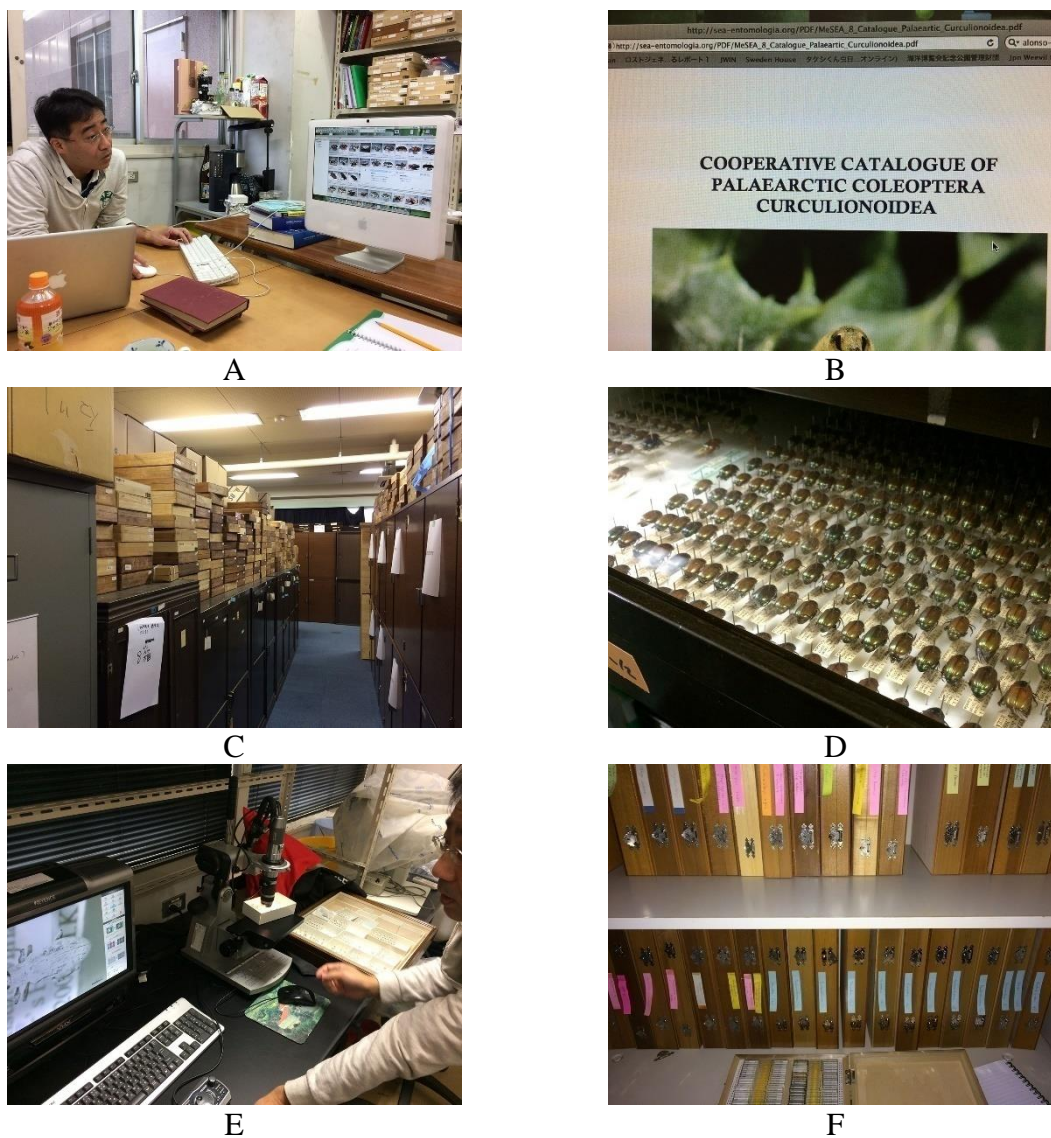


Figure 15 Weevils systematic and classification - Laboratory work at NODAI Atsugi campus (3-4, 6-7 December 2018)

- A. Prof. Hiroaki Kojima explained the diversity of weevils, how to find them in several host plants and the important quarantine weevils
- B. Weevils databases and websites were shown for further study
- C. Observation of insect collection and its management
- D. Insect specimens were sorted according to international principles
- E. High resolution stereo microscope was always used for taken images and used in reports and other researches
- F. Permanent slides of thrips collection

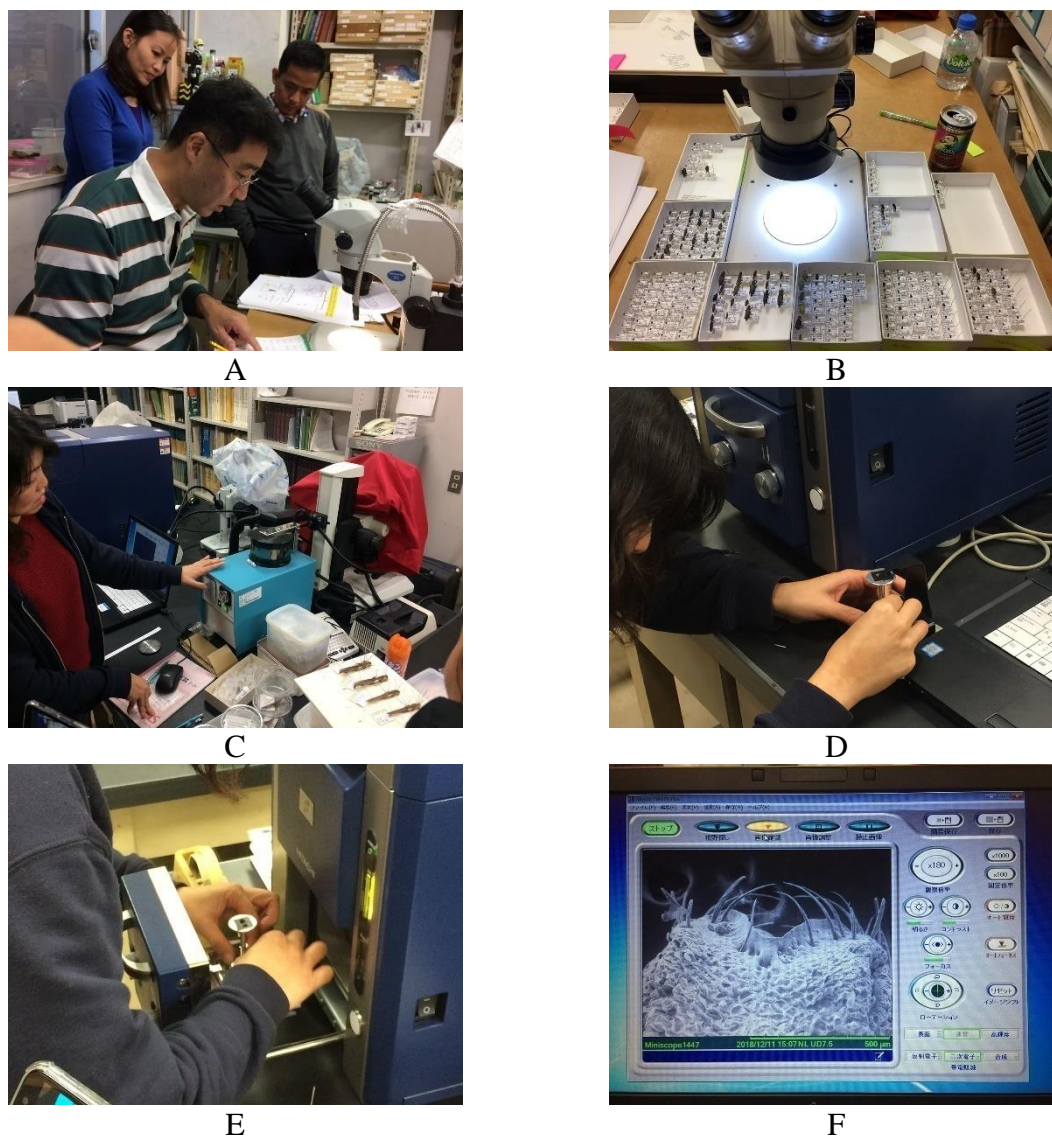


Figure 16 Sorting and observation of other insect taxa at NODAI Atsugi campus (10-11, 12-13 December 2018)

- A. The results of weevils identification were corrected by Prof. Hiroaki Kojima and important morphological characteristic were recorded
- B. Weevils from Malaysia and Vietnam were sorted by using illustrated key and grouped in same subfamily and tribe
- C. Scanning Electron Microscope (SEM) was demonstrated for participants
- D. Fix the specimens with adhesive tape and coated with platinum
- E. Prepare specimen in SEM
- F. Practiced to used SEM and captured important morphological characteristic of weevils



Figure 17 Visit to Fuji Flavor company(5 December 2018)

- A. Company presentation showed pheromone trap for monitoring cigarette beetles, red flour beetles and its morphological characteristics
- B. Observation pheromone trap and production line
- C. Exhibition of Fuji Flavor popular products
- D. Worldwide products
- E. All participants presented stored product pests, problems and its managements in their countries
- F. Group photo of participants and Fuji Flavor officers



Figure 18 Visit to Kanagawa Prefecture Museum of Natural History
(12 December 2018)

- A. Solar system exhibition
- B. Wild life exhibition
- C. Butterfly exhibition
- D. Insect Hall of Fame exhibition
- E. Dinosaur exhibition
- F. Stag beetles exhibition



Figure 19 Visit to the Research Institute of Evolutionary Biology of Tokyo University of Agriculture (18 December 2018)

- A. Insect Museum
- B. Insect drawers were collected in vertical and protected with rope
- C. Curator showed how to pinned and collected insect specimens
- D. Diversity of weevil
- E. Bhutan butterfly which received from Bhutan His Majesty
- F. How to dried specimens and suitable conditions were shown