SEAMEO BIOTROP
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BIOTROP Courier

Do You Know Stingless Bees?

BIOTROP's Acting DDP Joins FAO Global Launch of the UN Decade of Family Farming 2019-2028

BIOTROP's Director is Awarded Certificate of Merit in Forest Reclamation

BIOTROP COURIER

Address:

SEAMEO BIOTROP
(Southeast Asian Regional Centre for Tropical Biology)
Jalan Raya Tajur Km. 6, Bogor 16134
INDONESIA
Phone. +62-251-8323 848,
Fax. +62-251-8326 851
Email: kmd@biotrop.org
Website: www.biotrop.org

Director's Message

For this second quarter, we presented a novel innovation in combining digital technology with the conventional hydroponics practice to bring an easiness in managing the hydroponic system. Since 2017 we have been developing the digital prototype of sensors which has function to monitor several physical parameters used in hydroponics system. In addition, we raised an interesting topic about stingless bee which has been known to have many benefits for human such producing propolis as natural antibiotic. The details of this insect from taxa classification, apiculture, to end products are presented to you, so you may have a comprehensive information about the bee.

During April-June, we had conducted some training courses and activities as our direct actions for communities, namely: training course on the management of weeds and invasive plant species, training course on spatial and regional potential analysis, workshop on food processing, training course on fumigation, and Ciliwung care day. A total of twelve schools also visited us to learn about our facilities and technologies.

We were proud to have the Centre's Director awarding a certificate of merit from the Ministry of Environment and Forestry, Republic of Indonesia as an appreciation for his effort and contribution in conserving the ex-mining areas. We were also pleased to have Prof Dr Bambang Purwantara, our Affiliate Scientist and former Centre's Director, being assigned as one of the Board of Trustees of IPB University for 2019-2024 period. We do hope that their significant contribution results in a lot of positive impacts to society.

We were grateful that our Centre was invited to attend the Food and Agriculture Organization (FAO) Global Launch of the United Nation (UN) Decade of Family Farming 2019-2028. Our Acting Deputy Director for Program, Dr Aslan had the opportunity to present the Centre's roles in fostering youth and community in Indonesia through school garden and SMARTS-BE programs.

There were also resumes of two books published recently by the Centre, titled 'Ecology of Bedugul Basin Bali' and 'A Practical Guide to Mushroom Pharming', in which we hope you will discover full of knowledge to use.

All activities written in this issue illustrate the improvement of our Centre during the 2nd quarter of this year, and we further hope that more innovation and creativities will come up for better services.

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BIOTROP's Acting DDP Joins FAO Global Launch of the UN Decade of Family Farming 2019-2028

SEAMEO BIOTROP was invited by the Food and Agriculture Organization (FAO) to participate in the Global Launch of the United Nation (UN) Decade of Family Farming 2019-2028 program held at FAO headquarters in Rome, Italy (27-29/5). Represented by Dr Aslan as Acting Deputy Director for Program, the Centre presented its roles in fostering the youth and community to support the Family Farming Program Initiative in Indonesia and to assist the Government of Indonesia (GoI) in eradicating poverty level.

"Among many aspects of Family Farming, we suggest Indonesia to focus in developing literacy, nutrition, and entrepreneurship aspects of the youth, because this country has strategic demography and youth is the biggest contributor to unemployment according to data issued by the Statistical Central Bureau of Indonesia. Moreover, BIOTROP has also run school garden program and vocational school development program in the 30 schools throughout Indonesia, thus, it can be a good model for wider implementation scale," said Dr Aslan. This recommendation was well welcomed by the Secretary General of the Ministry of Agriculture (MoA) of the Republic of Indonesia HE Ir. Syukur Iwantoro, M.S., M.B.A, and the Indonesian Ambassador to Italy HE Ms. Esti Andayani.

In the future, Dr Aslan said that BIOTROP and MoA will further discuss the synergy between the Centre's and MoA's programs including the opportunity for students from agriculture vocational school fostered by the Centre to continue their study in agriculture polytechnic with full funding support from the GoI.

Ms. Esti also encouraged BIOTROP to take part in the activities of the Farmers' Agricultural and Rural Training Center (FARTC) in Tanzania which was established by the GoI, by providing experts to deliver training courses in agriculture for African farmers. This can also be supported by the database of superior seeds collected by Dr Supriyanto, the Centre's expert in natural products who is also the SMARTS-BE program's coordinator.

Group photo taken during the activity

In addition, Mr. Pierre Ferrand, a representative from FAO Regional Asia based in Bangkok, Thailand also invited Family Farming team from Asia Pacific including BIOTROP to collaborate in formulating and conducting effective programs that can be implemented in this region in near future. (zsp/al)

Dr Aslan delivers his presentation to audiences

Networking Development

For the second quarter of this year, we have established two Memoranda of Understanding (MoUs) with two institutions as follows:

Date of signing: 11 April 2019
Partner: SMKN 1 Mantangai
Topic: Improving the quality of vocational education
Duration: 2 years

Date of signing: April 2019
Partner: Universitas Diponegoro
Topic: Research activity, training course, technical guidance and consultation, information exchange, and staff development
Duration: 5 years

Group photo after MoU signing

BIOTROP's Director is Awarded Certificate of Merit in Forest Reclamation from MoEF

Dr Irdika Mansur, MForSc, SEAMEO BIOTROP's Director received an award certificate in forest reclamation from the Director General of Watersheds and Protected Forests Management of the Ministry of Environment and Forestry (MoEF), Republic of Indonesia on 22 April 2019. This achievement is a recognition of his effort and novel ideas in conserving ex-mining areas for 24 years, among others are integration of local tree species, introduction of essential bearing trees on ex-mining reclamation program, and establishment of swampy forest to manage acid mine drainage.

Besides being the Centre's Director, Dr Irdika is also a lecturer at the Department of Silviculture, Faculty of Forestry of IPB University since 1990. He currently also takes responsibility as Division Head of Program and Development of the Indonesian Essential Oil Board (DAI), and plays an important role as the Expert Team member of the Forum for Forest Rehabilitation on Ex-mine Sites (FRHLBT) and the Communication Forum for Indonesian Mine Environmental Management. He is also a member of Indonesian Microbiology Association and Indonesian Network for Acid Drainage (INAD).

Dr Irdika completed his bachelor's degree in the Faculty of Forestry of IPB University in 1988, while master's degree was awarded from the School of Forestry, University of Canterbury, New Zealand in 1994. He earned a PhD degree from Department of Biosciences, University of Kent at Canterbury, England in 2000. His fields of expertise include mycorrhiza, ex-mine land rehabilitation, silviculture, and agroforestry. Within the past ten years, he has authored and co-authored more than five books, as well as 63 articles in local and international journals and proceedings. BIOTROP also published some of his books, titled *Teknik Silvikultur untuk Reklamasi Lahan Tambang* [Silviculture Technique for Reclamation of Mine Sites] (as author), *Bekerja dengan Fungi Mikoriza Arbuskula* [Working with Arbuscular Mycorrhizal Fungi] (as co-author), and *Pupuk Hayati Mikoriza untuk Budidaya dan Rehabilitasi Wilayah Pantai* [Mycorrhizal Biofertilizer for Cultivation and Rehabilitation in Coastal Area] (as co-author). (zsp/asl/im)

KEMENTERIAN LINGKUNGAN HIDUP DAN KEHUTANAN
REPUBLIK INDONESIA

PIAGAM PENGHARGAAN

NOMOR : PL. 7 /PDASHL/KTA/DAS.1/4/2019

DIREKTUR JENDERAL PENGENDALIAN DAERAH ALIRAN SUNGAI DAN HUTAN LINDUNG

Menganugerahkan

PIAGAM PENGHARGAAN

Kepada :

Dr. Ir. Irdika Mansur, M.For.Sc.

KATEGORI PAKAR / AKADEMISI BIDANG REKLAMASI HUTAN

Jakarta, 22 April 2019
Dirjen PDASHL,

IB Putera Parthama, Ph.D.
NIP. 19590502 198603 1 001

Congratulations!

SEAMEO BIOTROP congratulates Prof Bambang Purwantara for his appointment as a member of IPB MWA (Board of Trustees) for the period of 2019 - 2024.

We wish him every success in the future endeavour.

Prototype of tool that has been developed

Students try using the tool

Students explain the tool utilization to Dr Zulhamsyah Imran (right)

SEAMEO BIOTROP Hydroponics Unit has currently been developing a prototype of smart hydroponic system. This system is being developed by Bayu Ramdhani, Dandy Fajar Pratama, and Rifki Alfiansyah. They are internship students from the Computer Engineering Department of IPB Vocational Program, who worked under the supervision of BIOTROP's hydroponics unit's respondent Riana Hartati and staff of Knowledge Management Department Haritz Cahya Nugraha.

The first phase of the prototype had been developed in 2017, in which its initial function was designed to monitor several physical parameters used in the hydroponic greenhouse: light intensity, temperature and humidity, and pH level. The second phase was started in late 2018 until early 2019 to add some additional functions for monitoring and controlling TDS (Total Dissolved Solid), water level and temperature by automatically powering the wall-mounted fan in the greenhouse.

The smart hydroponic system is an improved version of the conventional hydroponics, whereby a layer of digital technology is added, making it part of the Internet of Things (IoT) ecology, that opens up the whole new possibilities such as website-based monitoring, automatic control of connected peripherals, etc. Through this system, user will be able to automatically control the temperature, humidity, water and nutrient levels as well as to do online monitoring via web based interface.

This smart system has many benefits, including: 1) less water used (as it only uses water when necessary), 2) electricity efficiency (by automatically power the pump, fan, and lights), 3) higher yield of crops (by keeping the ideal level for the plant growth), and 4) less labour required (by making several tasks automatic).

Hydroponics itself is a breakthrough in plant culture system where water is the main component of the system instead of soil as growing media. In this system, the plants' roots are suspended in, flooded with or misted with nutrient-rich water which is delivered to the plant's roots continuously to provide them with all nutrients needed for healthy growth. Hydroponics may be a cost-effective solution for people who only have a little space such in urban areas. It is also an effective way to plant small herbs, flowers, fruits and vegetables.

After observing the prototype's trials, BIOTROP's Deputy Director for Administration, Dr Zulhamsyah Imran commented that the Centre would like to integrate digital technology with the existing technology such solar panel system in order to have better output. This prototype is a prominent start, and it will be completed in the near future, so that full scale of implementation can be established, not only in hydroponic unit, but also in other greenhouses and mushroom house as well. (hcn/zsp/asl)

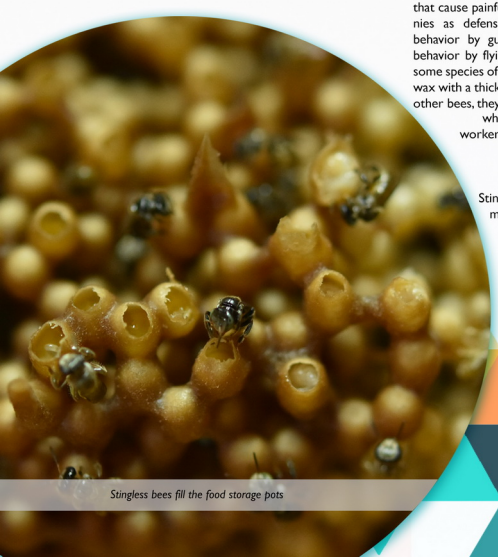
Do You Know Stingless Bees?

Since 2017, SEAMEO BIOTROP's Entomology Laboratory has been rearing stingless bees, particularly *Trigona* spp., for study and visit. Currently, the Centre owns eight colonies which have produced a total of 1.5 liter of honey, that the Centre called "Madu Biotri". The honey itself has many benefits for human health: anti-inflammatory, anti-microbial, anti-cancer, anti-proliferative, and anti-oxidant. However, how far do you know about stingless bees? Here, we deliver some interesting facts about these amazing bees.

Taxa Classification

Stingless bees are a large group of eusocial bees (about 500 species) closely related to common honey bees, carpenter bees, orchid bees, and bumblebees and belong to Apidae family. They have several genera, in which the two most important are *Melipona* and *Trigona*. There are 40 species of *Melipona* that have been known thus far, while *Trigona* has 80 species (Jalil *et al.* 2017). In Indonesia particularly, there are 31 species of stingless bees with various local names; for instance, teuweul (West Java), klanceng (Central Java), lanceng (East Java), galo-galo (Sumatra), and kelulut (Kalimantan).

In general, stingless bees are easily distinguished from other types of bee by the three characteristics, namely: 1) reduction and weakness of the wing venation, 2) presence of the penicillum (i.e., a brush of long, stiff setae located anteriorly on the outer apical margin of the hind tibia), and 3) reduction of the sting (Wille 1983). The worker bees have black color, big head, and sharped jaw, with 3-4 mm of body length and 8 mm of wing span, while the queen has brownish color, short wings, big abdomen, and three to four times bigger than worker bees in size.



Stingless bees fill the food storage pots

Origin and Distribution

Stingless bees have populated tropical earth for over 65 million years – longer than *Apis*, the stinging honey bees (Roubik 2006). The evidence is illustrated by the fossil of *Cretotrigona prisca*, a Nearctic meliponine, which dates back at least to the Late Cretaceous era (approximately 65 Mya) and is the oldest known Apidae. More recent stingless bee fossils include *Proplebeia* from Early Miocene Dominican and Mexican amber era (15–20 Mya), and *Liotrigonopsis* and *Kelneriapis* from Middle Eocene Baltic amber era (44.1 Mya) (Cameron & Rasmussen 2000).

Currently, stingless bees exist in most tropical and subtropical regions such as Australia, Africa, Southeast Asia, and parts of Mexico and Brazil (Yaacob *et al.* 2018), which have temperature between 18 and 24°C and humidity between 60 and 70%, respectively. These bees have been known to play an important role in ecology, economy, and culture of some tribes around the globe such as traditional Mesoamerican meliponiculture in tropical America during pre-Columbian times, who used the bees to produce honey for food, medicine, and religious purposes (Reyes-Gonzáles *et al.* 2014). They also act as the main pollinators within many tropical ecosystems (Cameron & Rasmussen 2000; Jalil *et al.* 2017).

Behavior

Stingless bees are active every day, but less active in cooler weather (Roubik 2006). Unlike other eusocial bees, they do not sting, but will defend by biting when their nest is disturbed. A few (in the genus *Oxytrigona*) have mandibular secretions, including formic acid, that cause painful blisters. Stingless bees may have very large colonies as defense mechanism. The worker bees have standing behavior by guarding the entrance of the hive and hovering behavior by flying near the entrance of the nest. In the evening, some species of stingless bees cover the outer entrance channel by wax with a thickness of <0.05 mm (Gruter *et al.* 2010). Similar with other bees, they live in colonies with a queen and many workers, while rear brood individually in cells. When the young worker bees emerge from their cells, they tend to initially remain inside the hive, performing different jobs. As workers age, they become guards or foragers

Stingless bees are generally monandrous, with a queen mating with a single male during a nuptial flight early in adult life (Green & Oldroyd 2002). The queen becomes receptive early after emergence and lose attractiveness soon after copulation. New queens are constantly produced throughout the year, which can mate when a queen replacement occurs or when the colony is swarming to make a new colony (von Zuben 2017). The gravid queens cannot fly (Roubik 2006).

Males in stingless bees have different behaviour compared to honey bees. After emergence, males remain few days inside the nest and then leave it and never come back. The males feed at flowers and sleep roosts along with other males (von Zuben 2017). They mate only once in life and leave detached portions (which function as mating plugs) of their genitalia within reproductive tracts of newly-mated queens (Green & Oldroyd 2002).

Hives

Stingless bees neither migrate nor being choosey in building colony hives. Their nest is the central place where the bees mate, forage and pass through life stages. It is immobile fixtures and potentially long-lived, much like trees in forests where the bees live (Roubik 2006). They usually nest in hollow trunks, tree branches, underground cavities, termite nests or rock crevices. Stingless bees are also known for their varied nest defenses. At any one time, hives can contain 300 to 80,000 workers, depending on species (Jalil et al. 2017).

Hives are built by bee workers using wax, resin, and mud. The common structure includes nest entrance, inner tunnel, brood cells, storage pots (for honey and pollen) and batumen layers (Sakagami *et al.* 1983). Inside the nest, there are different shapes and arrangements of brood cells and food storage containers. Honey and pollen are stored in separate pots. Stored nectar or ripened honey are in nest cavity extremes (for storage during heavy flowering periods), while pollen and some honey surround the brood area. The brood cells are spherical to ovoid, while food storage containers are small to large spheres, or are egg-shaped, or even conical or cylindrical. Pots are also often pressed together in odd units, forming individual cells on pillars or sheets of orderly cells on combs separated by the pillars (Roubik 2006).

Hives of the stingless bees

Pollination, Apiculture, and Bee Products

The specialty of the stingless bees is their ability to pollinate small-sized flowers due to their diminutive shape which cannot be achieved by the relatively big honey bee (Jalil *et al.* 2017). Many beekeepers keep the bees in their original log hive or transfer them to a wooden box, to make controlling process easier, even some beekeepers put them in bamboos, flowerpots, coconut shells, and other recycling containers.

Stingless bees have several characteristics as pollinators: a) workers pollinate multiple plant species and adapt to new ones; b) a worker usually visits only one plant species on a trip; c) colonies can be placed in hives, inspected, propagated, fed, re-queened, controlled for enemies, transported, and otherwise managed; d) workers are able to forage continuously and obviate the need to develop colonies each year; e) large food reserves are stored in nests; f) workers are possible to transfer in-hive pollen; and g) workers recruit nestmates to rewarding floral resources and provide information about the position of those floral resources (Heard 1999).

In terms of apiculture, stingless bees provide advantages as follows: 1) generally less harmful to humans and domesticated animals; 2) able to forage effectively in glasshouses; 3) contributing in preservation of biodiversity; 4) rarely able to abscond, as the old queen is flightless; and 5) resistant to the diseases and parasites of honey bees (Heard 1999).

The entrance channel of the nest

There is great variation of communication mechanisms in these bees. In some species, foragers returning from a food source produce weak sounds thereby indicating the existence of a rich food source. The duration of the individual sound pulses is in correlation with the distance of a food source. Other species such *Trigona spinipes* use scent trails to guide their nestmates to a food source. The foragers of *Melipona panamica* which collect at a poor food source turn at lower velocities than those collecting at rich food sources (Hrncir *et al.* 2000). The bees can pollinate flower within a radius between 100 and 500 m.

Stingless bees store pollen and honey in large, egg-shaped pots made of beeswax (typically) mixed with various types of plant resin; this combination is sometimes referred to as 'cerumen'. These pots are often arranged around a central set of horizontal brood combs,

wherein the larvae are housed. Young worker bees also secret royal jelly which is used as food for larvae of the designated queen bee and larvae of working bees. Nectar contains carbohydrates that are used by adult bees as sources of energy to forage and to defend their colony, while pollen contains protein that is used by young colony members (Jalil & Shuib 2014).

In general, stingless bees make far less honey, and therefore have less economic appeal, compared to honey bees (Roubik 2006). Honey of stingless bees is usually clearer, liquid and has a sweet and sour taste, which can be harvested three times a year. The honey is acidic due to its low pH (~pH 4), and are made up of 80% sugars, 17% water, and 3% various vitamins, enzymes, amino acids, and minerals. The composition of honey differs according to the floral source and origin (Amin *et al.* 2018). These honey contents can act as anti-inflammatory, anti-microbial, anti-cancer, anti-proliferative, and anti-oxidant (Yaacob *et al.* 2018).

In contrary with honey bees, propolis production in stingless bees is more abundant. Propolis, popularly known as bee glue, is a viscous bee product made by mixing insect secretions (saliva and wax) with plant resins. It is an important material related to the successful construction of the nest and the health of the colony. Propolis is used to seal the bee hive, preventing air and undesired visitors to enter. The anti-microbial properties of propolis provide a chemical defense against microbial action for the bees and their honey (Lavinas *et al.* 2018). Propolis of stingless bees is also used in medicine due to their various nutritional and therapeutic properties which can act as anti-inflammatory, anti-microbial, and anti-oxidant (Campos *et al.* 2015).

For more information about the beekeeping of stingless bees in SEAMEO BIOTROP, please contact Ms. Sri Widayanti, MSi, Head of Entomology Laboratory, at s_widayanti@biotrop.org and +6281111110093. (zsp/asl)

Trigona spp.

Honey produced by the stingless bees

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BIOTROP Trains Teachers on Identification and Management of Weeds and IAS

Sixteen (16) Agriculture Vocational Schools' teachers and five (5) representatives from research institutions and companies in Indonesia attended a training course on identification and management of weeds and invasive alien (plant) species (IAS) in annual and perennial agricultural systems conducted by SEAMEO BIOTROP on 25-30 March 2019 at its campus in Bogor. This activity aimed to support the revitalization program of vocational school in Indonesia through increasing and sharing knowledge and experience of teachers and through interaction with agroindustry practitioners.

Dr Irdika Mansur, the Centre's Director, in his opening remarks mentioned that BIOTROP is currently engaged in the weeds and IAS management because they may reduce up to 90% of annual agricultural production. A collaboration with related parties, especially the agriculture vocational schools and industries, to share the effective methods and experiences is required to have an effective management strategy. He also added that vocational school graduates may have higher chances to contribute to the improvement of agricultural production system.

The resource persons were Dr Soekisman Tjitrosoedirdjo, Dr Sri S. Tjitrosoedirdjo, and Ms. Sri Widayanti, MSi, from SEAMEO BIOTROP; and Mr. Vicki Rizki Arneldi and Mr. Waskito Aji from PT Syngenta Indonesia. They delivered seven topics: 1) Concept of weeds and invasive alien plant species; 2) Identification, taxonomy of weed species, and weed / invasive alien plant species data base; 3) Competition between crops and weeds; 4) Vegetation analysis, sampling technique, and its data analysis; 4) Principal of weed / invasive plant species management (critical period, economic threshold and integrated management in production system); 5) Herbarium management procedure and its processing technique; 6) Weeds and invasive plant species management (manual, mechanical, chemical and biological control); and 7) Herbicide application technique and its analysis.

Dr Sri Sudarmiyati gives a lecture to participants

Dr Soekisman, the Centre's IAS expert and also the training coordinator mentioned that a field trip to oil palm plantation of PTPN VIII at Sukamaju, Cibadak, Sukabumi, West Java was also needed to let participants have field experience in vegetation analysis and weeds identification, and to obtain information on weed control management system that is applied in the oil palm plantation at PTPN VIII.

During the training activities, four groups of participants presented their project assignments with the following topics: 1) Competition; 2) Vegetation analysis in the corn field with herbicide treatment; 3) Vegetation analysis in PTPN VIII oil palm plantation, Sukamaju, Cibadak, Sukabumi; and 4) Biological control of *Chromolaena odorata* using *Cecidochares connexa*. As a course requirement, they also formulated and presented individual action plans to be implemented in their respective institutions. (iw/zsp/rf/asl)

Participants conduct field course

Thirty-one Participants Join BIOTROP's Training Course on Spatial and Regional Potential Analysis for Natural Resources Management

SEAMEO BIOTROP in collaboration with the International Master Program of Information Technology for Natural Resources Management of IPB University conducted the 2nd national training course on the use of geospatial data and information for regional potential analysis for natural resources management on 22-26 April 2019, held in its Campus in Bogor. This training course was the advance level of the first one conducted in October 2018, intended to share knowledge and technical skills using spatial technology to analyze carrying capacity and regional capability. A total of 31 participants from various government institutions, research institutions, and universities throughout Indonesia joined the training course.

Group photo of participants and resource persons

In his opening remarks, the BIOTROP Director Dr Irdika Mansur emphasized that every region has different potentials including natural resources, which are needed to be explored. It has also been known that geospatial data and information are important, especially for formulating development plans and programs to optimize the regional potential. In the training course, all participants learned the potential spatial/regional analysis concept, conducted analysis on the regional carrying capacity based on determinant and spatial parameter. They also learned how to operate GIS software to explore and optimize spatial data from various resources.

Dr Impron delivers material to participants

Participants try using drone

During this five-day training course, five topics were delivered: 1) The importance of carrying capacity and region capability analysis for Indonesia's sustainable development; 2) Remote sensing optimization for natural resources potential analysis; 3) Hydrometeorology aspects in carrying it capacity and region capability analysis; 4) Dynamics spatial model usage on region resources management; and 5) Optimization techniques of spatial analysis using Builder Model on ArcGIS software. A field trip to Gunung Pancar, Sentul, Bogor to practice survey methods and surveillance using drone and GPS was also carried out.

Mr. Hendaryanto, ST, MSi, from the Ministry of Environment and Forestry of the Republic of Indonesia, and Dr Impron, Dr Zulhamsyah Imran, Dr Aslan, Mr Harry Imantho, MSc, and Mr Slamet Widodo, SSi, from BIOTROP were the experts provided the lectures and practical material in the above-mentioned topics. (uzf/zsp/asl)

Mr. Harry Imantho (left) and Mr. Slamet Widodo (right) give guidance to participants

BIOTROP Promotes Essential Oils in IFSR 2019 Exhibition

BIOTROP's staff give short presentation to the visitors during exhibition

SEAMEO BIOTROP with its specialization in natural essential oil distillation development became one of the nine government institutions and private organizations that took part in the International Forum on Spice Route (IFSR) 2019 exhibition at the National Museum, Jakarta (19-23/3).

The activity was organized by the Spice Land Foundation in collaboration with the Coordinating Ministry for Maritime Affairs of the Republic of Indonesia, and was attended by 500 people. With the theme 'Reviving the World's Maritime Culture through the Common Heritage of Spice Route', this forum introduced the historical glory of spices in Indonesia.

At present, Indonesia still ranks the fourth after China, India, and Brazil in this commodity. In fact, this country is known to have rich in plant resources including spices which can then be processed to produce essential oils. There are still many small-scale aromatic essential oil industries in various regions in Indonesia that are operated by refiners and farmers with traditional distillation methods. During the exhibition, the Centre presented an innovative method to produce essential oil's products (e.g., perfume, soap, and aromatherapy) which are more profitable.

"BIOTROP has produced essential oils from various plants including citronella, citrus, jasmine, tea, nutmeg, magnolia, and so on, and continued developing the products. The Centre also disseminates the knowledge to communities," said Dr Supriyanto, the Centre's Scientist who has been working on this matter. A demonstration of distillation process was also provided during the exhibition.

Mr. Jonner Situmorang, M.Si, a Researcher Assistant of the Centre's Natural Product Laboratory, had the opportunity to become a resource person at the event where he explained the roles of the Centre in the development of Indonesian spices that were in line with the school education program.

He further said, "Currently, there is no spice-related curriculum in Vocational High School (SMK) applied in Indonesia. Hence, BIOTROP encourages the schools to establish a program to distill essential oils from their local plants to produce perfumes and soaps. This program will positively affect both for improving the school community skills and for generating the school additional income."

Since 2018, BIOTROP has been facilitating and fostering 60 Agricultural SMK in Indonesia to develop their unique skills, including producing essential oils from plants through internship activity and training course programs.

To promote more values of tropical biology, during the exhibition, the Centre also displayed products from tissue culture laboratory (seaweeds and plant seedlings), from aquatic laboratory (freshwater lobsters and black ghost fish), and from entomology laboratory (stick insects and leaf insects). (as/wkd/zsp/asl)

BIOTROP Commemorates Indonesian National Education Day through Food Processing Workshop

In commemoration of the Indonesian National Education Day, SEAMEO BIOTROP conducted a Workshop on Food Processing to Enhance Community's Nutrition Level, in Bogor (2/5). This one-day activity aimed to share knowledge on proper food processing to retain food's nutrition and to demonstrate the appropriate ways of cooking foods. A total of 40 participants from Community Health Centres (Puskesmas), Agrianita of IPB University, schools, 3G-O Natural Farming and Food Community, and BIOTROP Women Association (PWB) joined this workshop.

Mrs. Novi Waskitasari, the BIOTROP Women Association (PWB) Chairperson in her opening remarks on behalf of BIOTROP's Director said that the workshop was designed to support the stunting problem prevention program and to provide education regarding proper food ingredients handling to improve community nutrition, particularly children. In addition, Ms. Dewi Suryani, the training coordinator, hoped that by joining this workshop the participants would be able to implement proper food processing handling.

This workshop featured four experts: dr. Drupadi H S Dillon, PhD, from SEAMEO RECFON, Prof (Res) Dr Ir Mohammad Winugroho, MSc, from BIOTROP, Mr. Hoo Eek Kee from Spice Islands Indonesia, and Mr. Norhashim Kamisan from Pewaris Bumi Hijau, who delivered materials on: 1) introduction to nutrition's health fact in Indonesia; 2) food processing to keep food's nutrition; 3) food cooking demonstration; and 4) agricultural cultivation with fertigation system, respectively. (uzf/zsp/asl)

Prof Winugroho gives lecture to participants

Mr. Hoo Eek Kee shows cooking demonstration to audiences

Ciliwung Care Day: Direct Action of BIOTROP for Community

SEAMEO BIOTROP participated in the Ciliwung Care Day activity, coordinated by the Fisheries Student Association of IPB University (HIMASPER IPB) on 24 March 2019 at the Ciliwung Watershed, Kedung Badak, Bogor. This activity was in line with the implementation of SEAMEO BIOTROP's program thrust in the improvement of environmental quality through community involvement. A total of 238 people consisting of IPB student associations, IPB alumni association (HA), NGOs, local governments, and local communities living near the river joined this activity.

In his remarks, Dr Zulhamsyah Imran, Deputy Director for Administration of the Centre said, Ciliwung Care Day activity is a movement to create better environment, so that the next generation will still be able to receive benefits from the river in the future. With regard to this, a collaboration with many related parties is necessary. He further explained that this environmental event was coherence with the Focus Group Discussion entitled 'Building Synergy and Collaboration in the Ciliwung River Management through the Ciliwung Care Movement', an activity held by the Centre in December last year.

During the activity, participants cleaned up debris found along the river. They also planted several tree species: jambolan (*Syzygium cumini*), santol fruit (*Sandroricum koetjape*), teak (*Tectona grandis*), ebony (*Diospyros celebica*), gandaria (*Bauea macrophylla*), kepel (*Stelechocarpus burahol*), and jengkol (*Archidendron pauciflorum*).

Some educational programs were also delivered to the local communities, namely: the compost making process, the construction of the park at the river bank, the importance of maintaining the environment, and information on river's water quality and biodiversity.

Also attending the activity were stakeholder representatives from Tanah Sareal sub-district officials, Dr Majariana Krisanti (representative of Dean of the Faculty of Fisheries and Marine Science of IPB), Ms. Nelly Oswini Subekti (Vice Chairman of HA IPB), and Mr. Een Irawan Putra (Ciliwung Care Community). (uzf/zsp/asl)

Fifty-one Participants Complete Training Course on Fumigation held by BIOTROP

Resource persons demonstrate how to use the equipment

A group photo of resource persons and participants

SEAMEO BIOTROP organized a training course on fumigation in the perspective of integrated storage pest management for fifty-one participants coming from various academic, government and research institutions, and companies in Indonesia on 8-11 April 2019 at its headquarters in Bogor. The activity was held to improve knowledge of the participants in preventing and controlling pest infestations in storage materials such as post-harvest, archives, library documents and museum.

BIOTROP's Director, Dr Irdika Mansur in his opening remarks emphasized, "Warehouse pest is a serious threat to commodity deposits, especially food and feed. Without good handling, the presence of these insect pests can cause enormous losses, both quantitatively and qualitatively." He further said that fumigation is an important component to overcome the problem of warehouse pests.

The training course provided knowledge and practical works on: 1) introduction of stored product insect pests, 2) integrated storage pest management, 3) destructive organisms of wood, archive materials and museum and its management, 4) technique of methyl phosphine fumigation, 5) technique of liquefied phosphine fumigation, 5) technique of sulfuryl fluoride fumigation, and 6) general pests control and their application tools.

Five experts shared their expertise in this training, namely: Sri Widayanti, M.Si, Dr Idham S. Harahap and Trijanti A. Widinni Asnan, M.Si, of SEAMEO BIOTROP; Mr. Ridwan Alaydrus, MP, from Agricultural Quarantine Agency of Indonesian Ministry of Agriculture; and Mr. Mohamad Rivai of PT Rebio Mega Aranda.

Mrs Sri Widayanti who was also the training course coordinator mentioned that by joining this activity, the participants would be able to implement the rules of proper fumigation in their respective institutions, and run management of storage pest more effectively. (sw/zsp)

BIOTROP Re-establishes Its Public Relation Unit

In its early establishment, SEAMEO BIOTROP had its Public Relation unit with its activities covering publications and information dissemination through brochure, leaflet and broadcasting. However, in mid-1990's, the unit was then solely managed until the new administration system was introduced.

It was then realized that the Centre needs strong marketing policy and an active Public Relation that could provide information on the Centre's activities and services. With this in mind, BIOTROP re-formed a public relation team last February in its campus, Bogor. The establishment of the team aimed at providing more effective communication in gaining and disseminating information and services available at the Centre. The team members consist of 10 representatives from each department and unit under the Centre.

Ms. Rima Febriana, the Knowledge Managaement Manager and the Team Leader expressed, "This team is formed to strengthen marketing management and to provide an up-to-date information in a catchy and attractive appearance so that people will be aware of the Centre's existence and activities. The team members will take responsibility to provide monthly information on knowledge and activities related to their work units as well as to maintain its quality."

As the first step, the Centre had improved the writing skill of the team members by holding a training course on writing news and feature articles on 23 April 2019 at its headquarters in Bogor, with Dr Jess Fernandez, Deputy Director of Program of SEAMEO RECFON as the resource person. Twenty other staff and research assistants were also participated in this activity, as their field of work is also considered as an information source.

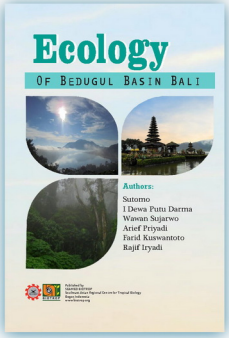
The team leader further mentioned that in the near future, a discussion will be conducted to maximize the use of social media, website, printed materials, and face-to-face method for delivering information. It is hoped that the re-establishment of this public relation team with its new information dissemination system will increase the visibility of the Centre in Southeast Asian region and the number of shared significant knowledge to communities. (zsp)

Ecology of Bedugul Basin Bali

Montane forest has become the last sanctuary for most of Bali's biodiversity due to massive deforestation and degradation occurred in the lowland areas (Lavigne & Gunnell 2006; Smiet 1992; Whitten *et al.* 1996). Forested areas in Bedugul Basin are among the remaining tropical montane rainforests in Bali, which play an important role in maintaining the biosphere, preventing erosion, preserving biodiversity, and functioning as a water source and buffer zone for surrounding areas. Nevertheless, the forested areas in Bedugul, especially near Beratan and Buyan Lakes and also Mt. Pohen, are increasingly exposed to tourism activities and facing other anthropogenic disturbances such deforestation. Hence, ecological research in these areas is needed to identify and assess any potential damage, so that its natural resources could be protected and sustained in the light of climate change era.

This book is a compilation of relevant research works that were conducted in Bedugul Basin, Bali. Most of them were carried out by the authors themselves and in collaboration with colleagues from Bali Botanical Garden. The new study of species distribution modelling (SDM) using Biodiversity and Climate Change Virtual Laboratory (BCCVL) for *Dacrycarpus imbricatus* (which is one of the character species of the area) is also discussed in this book. Another important and recent research output is the elaboration of autecology aspect of the endemic plant species, *Pinanga arinasae*, which can be only found in Mt. Tapak Bedugul.

This book should fill some research gaps in the ecological-ethnobotanical aspects of the plant community of high elevation landscapes in Asia, particularly Indonesia. The book would be a useful reference to the scientific community in the ecology and ethnobotany fields. (wkd/zsp/asl)

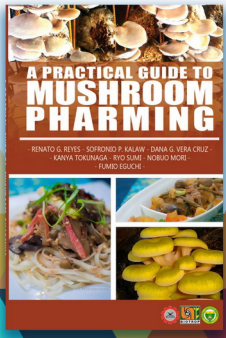


A Practical Guide to Mushroom Pharming

This book is served as a practical guide to mushroom pharmers, consisting of mushroom growers, development workers, and researchers. Every activity in mushroom pharming is presented in pictorial styles, so that readers can easily follow the steps. This book was written in response to the need of the mushroom industry to have a simple, comprehensive, and practical guide on spawn and mushroom production. The procedures have been simplified in order to be more popular even to non-mushroomologist. It consists of the basic and applied aspects of mushroom science and technology.

In the first part of the book, readers are introduced to the world of mushrooms, particularly mushroom's structure, biological reproductive and classification, and nutrition. It also provides information regarding the nutritional composition, medicinal, and nutraceutical attributes of mushrooms. Mushroom species that can be cultivated on various lignocellulosic substrates are also highlighted. The other parts present detailed procedure in the preparation of culture media, grain spawn production, substrate preparation, problems in mushroom production with their recommended solutions, and potential economics of mushroom production.

The book goes beyond the traditional knowledge that mushrooms are only regarded as culinary ingredients. Readers will be also introduced with different recipes of mushroom. In the last part of the book, mushroom spent is used as the main ingredient of compost for organic production of crops. (wkd/zsp/asl)



Let's Visit Our Centre!

During the 2nd Quarter of 2019 (April-June), SEAMEO BIOTROP welcomed visitors from academic, research and government institutions, and companies, namely:

Indonesian Teacher Association (IGI), Bogor,	09 April 2019
SD Al-Kautsar, Bogor (4th grade students),	11 April 2019
Data & Documentation Center of LIPI, Jakarta,	12 April 2019
SMK Kesehatan Annisa, Bogor,	16 April 2019
PT Darya Varia, Bogor,	23 April 2019
SMAN 49, Jakarta (Young Scientific Group),	24 April 2019
Kasetsart University, Thailand,	24 April 2019
Isotop and Radiation Application Center (PAIR) of BATAN,	25 April 2019
SMP FIWA (Fitrah Islamic World Academy), Bogor,	26 April 2019
Vocational School of IPB University, Bogor,	29 - 30 April 2019
Directorate of PAUD Dikmas, and	15 Mei 2019
Musamus Merauke University.	12 June 2019

The Centre introduced its facilities and technologies to the groups and opened any possible collaboration in any aspect of tropical biology.