BIO Bulletin 2017

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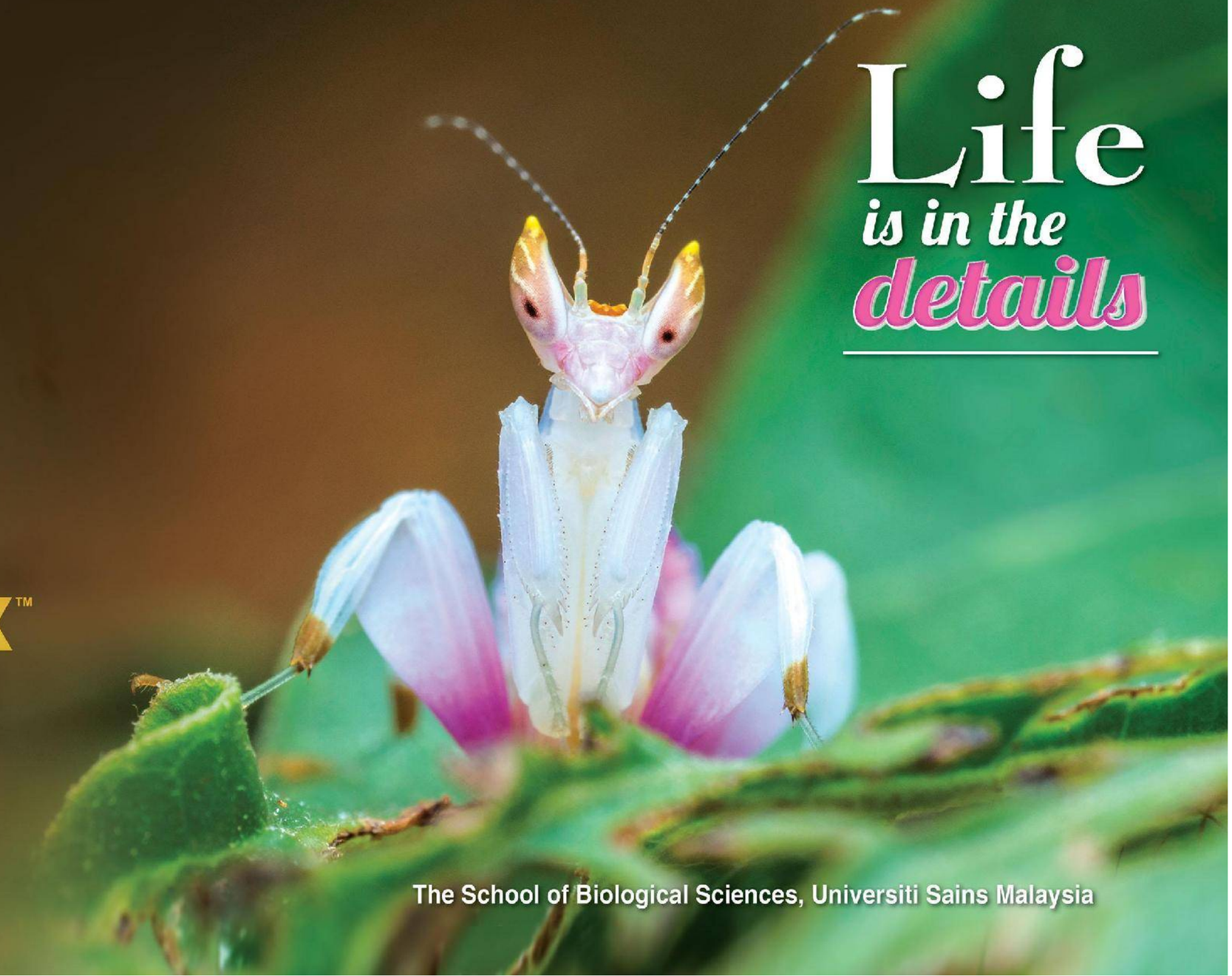
Vol 1 | June 2017

Life is in the details



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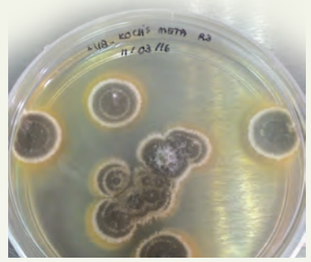

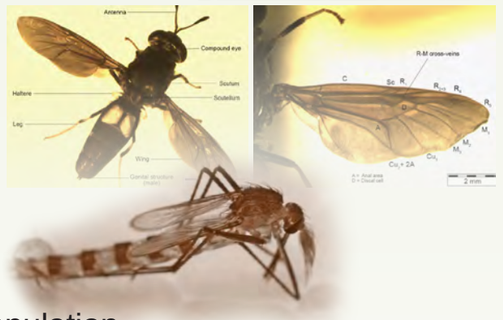

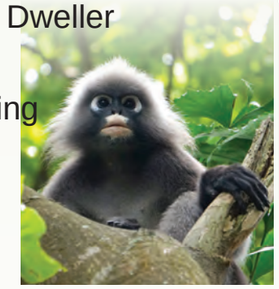

EDITORIAL

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Bio-Bulletin June 2017

Dean Foreword

This is the first issue of Biobulletin since my appointment as dean more than a year ago. I wish to take this opportunity to welcome the editorial team members, many of whom are reappointed after two years tenure since 2014. The bulletin was initiated as a platform of communication within and beyond the school. This effort will continue to be shared in both hard and soft copy (via our Bioschool website).

For many years the school has remained competitive as one of the top key performers in USM. To place ourselves at the forefront of research, we strive to form close partnership with international institutes. A total of 15 MOA/MOU were signed in 2016/2017, of which 6 were with oversea institutes mainly from Japan.

We have quite a number of senior academicians leaving the Bioschool this year. For my colleagues who journeyed with us, I would like to extend my deepest gratitude to Prof. Siti Azizah Mohd Nor, Prof Darah Ibrahim, Prof Razib Samian, En Ahmad Ramli Saad and En Mohamed Hifni Mohd Baharuddin. I wish them happiness in their retirement living.

In this issue, you will find interesting articles about the work carried out by our researchers. We have a good mixture of articles from entomology, primatology, ecology and microbiology.

Finally, let us not forget the main aim as an APEX university to sustainable nurture the nation towards world class entity in terms of research. I encourage all academic, administrative, and technical staff to work together and continue to support School of Biological Sciences in the future.

Thank you.

Professor Amirul Al-Ashraf Abdullah

Dean, School of Biological Sciences

Chief Editor's Foreword

First, on behalf of the editorial team, I would like to express our thanks and gratitude to Prof Ng Wing Keong, the previous Chief Editor of Biobulletin. I would also like to thank the editorial team who had dedicated their time and effort for this bulletin.

Special thanks go to Dr Nik Ahmad Irwan Izzauddin Nik Him for the astounding macro photography skills. The cover image is a close up of the Malaysian Orchid Mantis, *Hymenopus coronatus*. First described by Olivier 1792, the delicate and cryptic design of the mantis even caught the attention of Alfred Russel Wallace who called the mantis rare. This picture exquisitely captures our theme of life is in the details. Science is about the exploration of life, from the smallest of atoms to the largest of structure in the universe, the Hercules-Corona Borealis Great Wall.

Similarly, our articles in this edition of Biobulletin cover the mycobacteria, fungi, figs, mosquitoes, flies, Loach, and langurs (from the minute to the biggest in term of size). In the happening section, we have information on a few international events and a special tribute to Jane Goodall. We also have a field article on Baling area, an area most people are familiar with, but have no idea that it holds a trove of biodiversity treasure. There is also a good article on communication tips on how to interact with the media from a scientist perspective.

I hope you enjoy this edition of Biobulletin and we are hoping to come out with another edition before the year ends.

Thank you.

Associate Professor Dr Nik Fadzly

How do you solve a problem like *Mycobacteria*...?

Siti Khayriyyah Mohd Hanafiah

Quick trivia: What do the Bronte sisters, George Orwell, Franz Kafka and Cat
Stevens have in common?

They were great writers, certainly.
But more importantly, they all had tuberculosis, or TB.

Caused by one of the most successful pathogens known to humans – the *Mycobacterium tuberculosis* (MTB) -- TB has caused demise since before the time of the Egyptian Pharaohs, and ravaged young adults in "consumption" through the 1800's. Today, while it is a rare occurrence in most high-income areas, TB remains a strong cause of death among millions of people who are socially vulnerable and living under conditions of poverty.

But how does TB remain so prevalent throughout thousands of years of human civilization? The key to success of a parasitic organism is to obtain the necessary nutrients and defend itself from the immune system -- without killing the host before it can exit and infect new hosts. In this aspect, the MTB may have perfected this art. Most TB infections do not manifest with people coughing blood up their lungs, as we would imagine from watching television shows like House and ER. Most people who have ever been exposed or even infected with TB would be able to go on with their lives blissfully unaware.

In this so-called "latent" TB infection, the mycobacteria live within granulomas made from the hosts' immune cells. This structure results from the immune system's effort to cut off further spread of the infection, but ultimately serves to protect the mycobacteria, like an antibiotic-proof sleeping bag for them to rest, and be awakened at a future time. This time may in fact never come, and individuals may die without ever knowing they harbored these bacilli in their lungs. However, when the immune system falters, commonly due to HIV infection or the use of medicines that suppress the immune system, granulomas are disrupted and disintegrate, freeing the mycobacteria. The TB disease is then considered "reactivated" and the infected host is now able to spread airborne bacilli to new hosts with every cough.

Likely due to this effective means of transmission, it was previously estimated (based on studies measuring TB exposure using the classic tuberculin skin test) that one in every three people in the world was infected with latent TB. However, newer, more specific diagnostic tests such as the interferon gamma release assays (IGRA) challenged this idea of a binary outcome and a more complex picture emerged. Upon exposure, a spectrum of outcomes can occur based on a multitude of host and pathogen factors, and even then, the status of a person infected with TB appears to be very dynamic (Figure 1). This led to a better appreciation of the complexity in host-pathogen interaction and alludes to the very heterogeneous and often mysterious nature of the human immune response to MTB infection. Together with the length of time it takes between primary TB infections and when symptoms (if any) appear, it becomes even more difficult to truly estimate what proportion of the world is actually carrying infectious TB.

In practical terms, this heterogeneity and complex interplay of immune responses has challenged decades of efforts to produce better tools of diagnosing TB disease (Figure 2). While we were able to laud advances in rapid, simple finger prick blood-based tests that can be used to diagnose HIV infection in resource-limited areas without a laboratory infrastructure, the same could not be said of TB. Indeed, until today, the approaches for TB diagnosis remains the same as when Robert Koch first described these bugs over a century ago – checking for acid-fast bacilli in sputum under a microscope or growing it on culture. These methods are fine for research, but they are cumbersome, time-consuming, and difficult to deploy as diagnostics to where most TB patients can be found. Sophisticated molecular tests to detect TB DNA are now used in some laboratories, but they too remain difficult to scale up in resource-limited settings.

What many do not realize is that while the most significant changes in disease epidemiology tend to occur due to effective treatments, they are also dependent on the availability of tools to diagnose

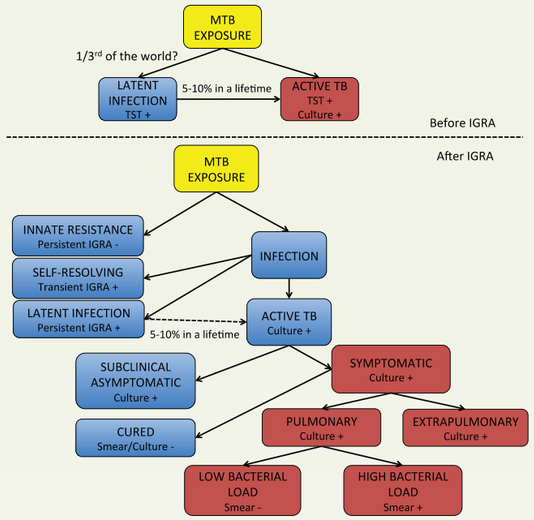

Figure 1. Schematic diagram of possible outcomes following MTB exposure. While it was previously thought that exposure to TB would lead to active infection in 10% of individuals and latent infection in 90% of individuals, recent data suggests that TB manifests on a spectrum of diseases rather than a binary outcome.

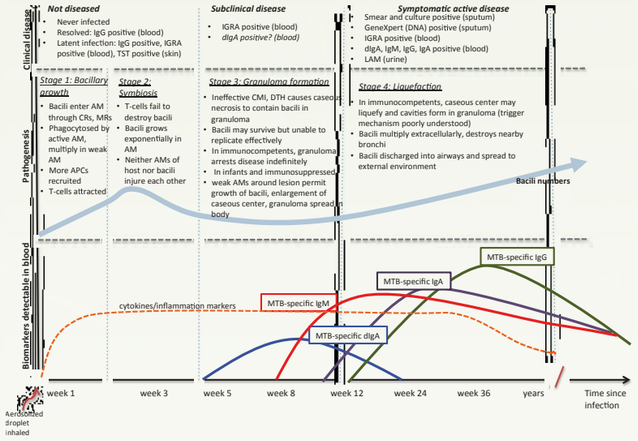

Figure 2. Summary of TB biomarkers detectable in blood in relation to stages of disease. Note that this hypothetical timeline is intentionally oversimplified and conjectured from available evidence. Granulomas are highly diverse within the same host, and individuals may fluctuate between latent and active states in any period of time. AM: Alveolar macrophages; CR/MR: complement/mannose receptor; APC: antigen presenting cells; CMI: cell mediated immunity; DTH: delayed type hypersensitivity; IGRA: interferon gamma release assay; TST: tuberculin skin test; LAM: lipoarabinomannan.

Dr. Khayriyyah's research interests lie primarily in tuberculosis host-pathogen interactions and biomarker discovery using immunological and protein-based approaches, geared towards meeting unmet diagnostic needs in resource-constrained settings.
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the disease early. For example, where HIV was a death sentence when it was first described in the 1920's, it has now become largely a chronic illness that can be managed with anti-retroviral therapy. This is primarily because a first screening test can be done as easily for someone in Kuala Lumpur as well as for someone living in a remote village in Borneo. What hampers the quest for simpler, faster TB diagnostics, is a lack of validated biomarkers -- signals of disease that can be detected in less invasive, easier to handle samples like finger prick blood, saliva or breath. Low specificity has already posed a major hurdle due to "false positives" in healthy people who were once exposed, or people with latent, subclinical or extrapulmonary TB (Figure 1), or people infected with any of the ubiquitously found cousins of MTB in the environment, or any other category of "control group" who appear to not have TB on sputum-based tests, but carry TB signatures in bodily fluids. There is also the threat of low sensitivity, as sputum-culture remains an imperfect gold standard test for children (who have difficulty producing sputum) and paucibacillary or extrapulmonary TB (who may not have detectable mycobacteria in their sputum). Under these two situations, finding a reliable biomarker becomes an almost impossible task.

In short, because of the long-intertwined history between TB and its human hosts, we have so far been unable to produce tools to enable early diagnosis of TB. Because we are unable to diagnose early, we become unable to treat infected people who may be spreading the disease unknowingly. And because of this, TB continues to survive and spread, firmly integrating itself in the course of human history.

So until further notice, the frustrating question remains:

How do you solve a problem like mycobacteria? How do you catch this bug and bring it down?

How do you find the mark that means mycobacteria?

A flibbertigibbet! A will-o'-the wisp! A clown!

The Discovery of Malaysian Entomopathogenic Fungi, *Metarhizium Anisopliae* META G-4 isolate as a New Potential Mosquito Bio-Larvicide

Rohaiyu Rodzay and Wan Fatma Zuharah*

Figure 1: A green muscardine culture of *Metarhizium anisopliae* META G-4 isolate on PDA agar.

Entomopathogenic fungi, *Metarhizium anisopliae*

For about 130 years, entomopathogenic fungi have been well known as natural antagonists for the control of insect pests. Entomopathogenic fungi are specifically adapted fungi evolved to parasitize insects, nematodes and other invertebrates in a natural environment. One of the most common entomopathogenic fungus mainly used as a biological control agent against agricultural pests is *Metarhizium anisopliae*. *Metarhizium anisopliae* was discovered by Metscnikoff (1879) on wheat cockchafer *Anisoplia austriaca* and originally was named as *Entomophthora anisopliae*. Later, after the establishment of Genus *Metarhizium*, it was renamed as *Metarhizium anisopliae* by Sorokin (1883).

Metarhizium anisopliae has a worldwide occurrence and a wide host range whether on insects or within the cysts of nematodes and as well as in the soil. Commonly, this fungus can be found abundantly in the soil as it is a part of the soil flora. It can be easily isolated and cultured in any artificial media. The typical green conidia will be grown abundantly on the surface of new culture media. Under microscopy observation, this so-called green muscardine fungus can be further identified based on the arrangement of the phialides bearing chains and slightly ovoid in shape of the conidia.

The potential of *Metarhizium anisopliae* isolates as larvicidal and mosquitocidal agents

Even though, *Metarhizium anisopliae* has a wide host range, most of the hosts are soil-dwelling insect pests and mosquitoes are not listed as one of the natural hosts. However, based on the potential of *Metarhizium anisopliae* as bio-control agents of insect pests, various studies have demonstrated the possibility of using *Metarhizium anisopliae* as natural pathogens for several development stages (eggs, larvae and adults) of mosquitoes. The performance of *Metarhizium anisopliae* as biolarvicidal agents against mosquitoes has been demonstrated in other countries such as Brazil, United Kingdom, Netherlands and many more. The tests outline promising results against laboratory strains of *Aedes albopictus* and *Aedes aegypti* mosquitoes.

In Malaysia, the usage of *Metarhizium anisopliae* is still at a pioneer stage and it is only adapted for the control of agricultural pests. There is lack of study on the potential of this fungus as one of mosquito bio-control effort. Since previous scientific findings have suggested the possibility of this fungus as one of bio-natural agent against mosquito, this has encouraged us to try and find potential strains of *Metarhizium anisopliae* from Malaysia that can be used as new potential mosquito bio-larvicide agent.

Our research

Malaysian entomopathogenic fungus *Metarhizium anisopliae* var. *anisopliae*, isolate strain META-G4 isolated from agricultural soils in Felda Tenang, Setiu, Terengganu (N05°32.079', E102°31.626) was chosen to investigate the effectiveness on mosquito larvae. This project is in collaboration with

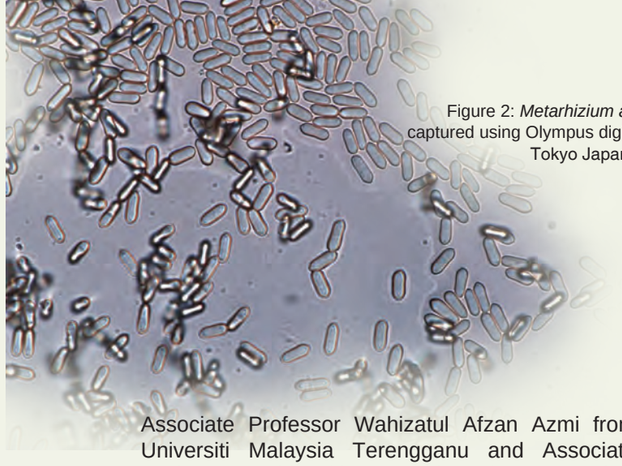

Figure 2: *Metarhizium anisopliae* META G-4 isolate captured using Olympus digital camera (Olympus DP72, Tokyo Japan) under 100x magnification.

Associate Professor Wahizatul Afzan Azmi from Universiti Malaysia Terengganu and Associate Professor Hideyuki Nagaoka from Tropical Mycology Laboratory, Universiti Sains Malaysia for the establishment of the fungi colony. Our study was designed to test the possibility of using *M. anisopliae* META-G4 strain for the larvicidal assay test on *Aedes albopictus* and *Aedes aegypti* larvae. To distinguish the comparative efficacy of *M. anisopliae* towards laboratory strain and field strain larvae of both *Ae. albopictus* and *Ae. aegypti*, we compared the baseline concentration and the susceptibility of both Vector Control Research Unit (VCRU) laboratory and field strains of *Aedes* mosquitoes of urban and sub-urban regions in Penang towards *M. anisopliae*.

Both of field strain of *Ae. albopictus* and *Ae. aegypti* were collected from the dengue hot spot areas in Penang Island, Malaysia; Sungai Dua and Batu Maung. The extensive usage of insecticide during fogging activities after cases notification has been reported to cause insecticide resistance in *the Aedes population* in those areas. Interestingly, our findings showed the high susceptibility of field strains to *M. anisopliae* indicating the pathogenicity of this fungus might be effective against resistant mosquito populations in our sampling locations. Furthermore, the assay demonstrates that the treatments using *M. anisopliae* isolate META-G4 were highly effective and was able to kill 100% of both *Aedes albopictus* and *Aedes aegypti* mosquito larvae at a conidia concentration of 1×10^6 conidia/ml within the treated period.

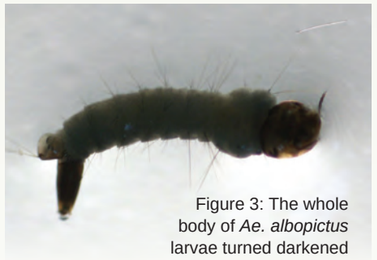

Figure 3: The whole body of *Ae. albopictus* larvae turned darkened after treated with the *Metarhizium anisopliae.*

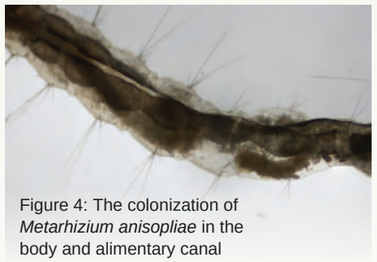

Figure 4: The colonization of *Metarhizium anisopliae* in the body and alimentary canal of *Ae. albopictus* larvae after infection.

The mosquito larvae infected with *M. anisopliae* treatments showed severe morphological deformities such as hydrated and swollen body with high conidia concentrated inside their body. Generally, the start of entomopathogenic fungi invasion is triggered when the conidia is attached to a susceptible host and germinate inside the body of the host. However, hydrophobic tension created between conidia and the cuticles of mosquito larvae in the solution had changed the events of colonization of conidia on the mosquito larvae cuticle. Based on feeding behaviour of *Aedes* larvae which usually browse by scraping to filter out the food suspension towards the mouth. Surprisingly, the larvae has increased the chances of taking in the *M. anisopliae* conidia through ingestion. The conidia will germinate and penetrate the siphon and spiracles, blocking the breathing mechanism of the larvae. Simultaneously, the toxins released by the fungus also will also cause the degeneration of the host tissue, which eventually leads to the loss of structural integrity of the larvae.

Conclusions

The path to finding a suitable agent to combat the expanding populations of *Aedes* populations is very challenging. *Metarhizium anisopliae* fungi can considered as an excellent candidate due to their safety (in term of hazard to humans), limited host range, ease of production and suitability of large scale production. The finding from our study also justified the ability of *M. anisopliae* as a new potential bio-control agent for the control of *Aedes* mosquitoes. Since the occurrence of this fungus is a part of the natural flora, it has been certified to have no adverse impacts on mammals and consider as safe with minimal risks. Hence, the commercial application of this fungus should be considered as a new important bio-control agent in vector control program.

Assoc. Prof. Dr. Wan Fatma Zuharah Wan Musthapa is a medical entomologist. Her research interests are focused on the control of vector-borne disease and neglected tropical disease. Email: wfatma@usm.my

Rohaiyu Rodzay is a postgraduate student working on finding the potential bio-larvicide and synergism between plant extract and entomophatogenic fungi to curb the Aedes mosquito populations.
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Mycelia:

The fungal ‘internet’?

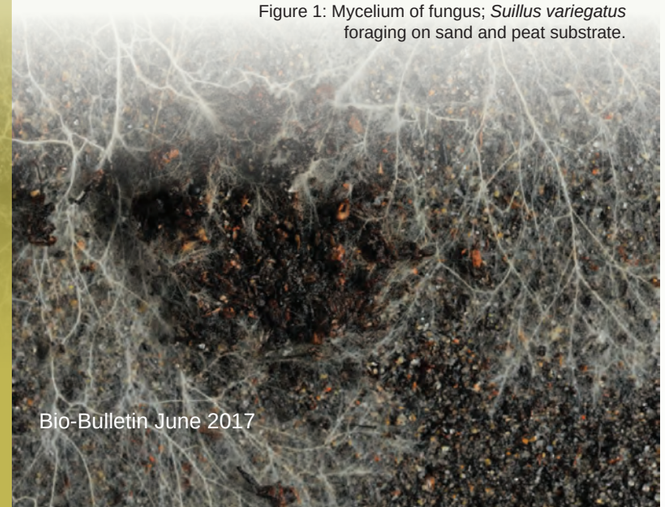
Rosnida Tajuddin

Mycelium is the interwoven collection of string-like hyphae structure that protrudes out of any fungal body. Hyphae, which is only one cell thick will elongate and branch either apically or laterally to form a network of mycelium over acres of soil. The main reason behind the interaction or transferring signals between hyphae and other organisms is that hyphae is capable of branching out into a larger surface area in radial form. Mycelium is the neurological network of nature that can expand to thousands of acres in size in cellular mats achieving the greatest mass of any individual organism on this planet. Mycelium is able to travel across the landscape with a surprising speed up to a few inches in a day. Since mycelium is not plant host specific, they can cover the roots of different plants over a large scale of soil. The function of mycelium is to decompose plant debris and return the nutrients to the soil to be used up by the plant and animal later. Here, we will examine whether there is any correlation or resemblance between bodies of mycelia and the Internet, in terms of their structure, their functional role and lastly their power and influences in a community.

Mycelial network under the process of natural selection, has resolved to minimize the survival cost in turn for the greater benefit in nutrient gain and adaptability. Over the course of evolution, it has evolved the ability of mapping the shortest and energy saving pathway in terms of food foraging, most significantly in developing cross-hatching network to re-route in case of breakage of mycelium strand. This adaptation greatly enhances the efficiency of nutrient transfer within the fungal hyphae. Furthermore, the pattern of mycelium connection has been proven to be conformed to the exact mathematical optimization curves developed in speeding up our Internet.

The structure of mycelium is more than just an underground network extension of a plantation above ground. Recent studies have concluded that mycelia establish a more complex underground network that extends to form both intra and interlinks connection from trees to trees. Furthermore, it has also been revealed that it forms connection in a general manner and does not focus on any specific host type. Mycelial network is not surprisingly a stable network organization in which it would not be readily affected by random distress emitted in its proximity. One of the reasons for the sturdiness of such topology is because of the non-uniform design of the physical network. This group of network system is categorized as ‘scale-free networks’; in which the networks concerned in this study (mycelial network and the Internet), including few others, such as the social network and cells, fall under this category. This could probably translate into a solid relationship between mycelium structure and our communication system. Fact as it is, mycelium plays a pivotal role in information transfer. It was found that the colonies are constantly sampling their immediate environment, performing rapid ‘chemical test’ in keeping track of any microclimatic changes. This enables them to coordinate suitable responses by adjusting their internal assembly line to tackle any possible harmful effect brought about by the sudden changes. Its resonance with the way the Internet works, i.e. regulating information flow between users of a different geographical region, which, eventually contributes to the sharing of information.

Figure 1: Mycelium of fungus; *Suillus variegatus* foraging on sand and peat substrate.



The primary role of network is to enable the transferring of substance between one node and to another. In the mycelial network, mycelia not only functions as a symbiotic connection between plant organisms, but it also enables the bidirectional trafficking of materials such as carbons and nutrients across. This also holds true for network of computer nodes, in which connecting links enables the downloading of packaged data from server to clients, and similarly, uploading from clients to server. There are numerous extensive pathways for carbon transfers, namely through soil and also the mycelial network. They also concluded that the amount of carbon transferred through the mycelial network is three times higher than it is transferred through the soil.

Figure 2: Mesocosm of pine colonised by ectomycorrhizal fungus; *Suillus variegatus*. The red arrow indicated the mycelia of *Suillus variegatus*.

In addition, the ‘connectedness’ and complexity of both networks (the mycelial network and also the Internet) give rise to the phenomenon of small-world. In a study, researchers have found that both mycelial network and the Internet have a striking similarity in which both network are able to extend across, unaffected by the limitation brought by the spatial distribution of the population and the topological limitation. Not only that, in the same study, they also found that on mycelial network the complexity of the connected hyphal nodes of a particular tree, shows a definite correlation with its age. A node here points to any connecting points at which a pathway is formed. This means that the older the tree is, the more extended its mycelial network.

Communication is the other important role of both the mycelial network and the internet. In a common term, communication is the information exchange and interaction between one node to another. The mycelial network not only enables connected plants to communicate, but they are also able to pick up defense signals emitted from their neighbor in the face of any critical situations. This therefore increases the host defense system; because they are able to take precaution and have all their time to stage out their defense mechanism before the damaging situation strikes them. An exemplary study conducted with mycelial network of infected tomato plants by Song *et al.* (2010) showed that tomato plants connected through the mycelial network with infected neighboring plants, suffered less damage and has higher defense mechanism than those that were not connected through the mycelial network.

The mycelial network also serves as a backbone in any functioning terrestrial ecosystem since it is estimated that 80% of plants are being connected into this network. Vegetation survival in an ecosystem fiercely depends on the mycelial network. This is because, not only it provides a mean of information exchange and communication among plantations; it also enables nutrient transfer among connected nodes in the community; it warns plantation of possible damage ahead and it assists the growth of young seedlings.

In conclusion, it is agreed to a certain extent that mycelia does resemble the Internet in terms of the structure of its network, its functions and how it reaches out to its community. Mycelium is the fungi Internet that interacts and connects to various organisms. Its structure resembles the mammalian brain and the internet in which information is transmitted between hyphae in the mycelium**.** From now on, maybe we can ask ourselves this question: How much do we know about fungi? Be it a friend or a foe, recent discoveries have led to an unsettling conclusion: The fungi may in fact genetically smarter than who we are.

Dr Rosnida Tajuddin research interests are concerned with the identification of mycorrhizal fungi and macrofungi, understanding ectomycorrhizal fungi and macrofungi community and distribution in Malaysia rainforests, and nutrient transportation in ectomycorrhizal and arbuscular mycorrhizal symbioses. Special thank you to Siti Sarah Amirah Hannes, Chan Chui Ling and Wong Xi Yan; final year biology students Batch 2015/2016 for the contribution of idea.

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Black Soldier Fly

Hermetia illucens (Diptera: Stratiomyidae): Prospect for organic waste management

Hadura Abu Hasan and Naim Mohd Yusuf

The organic waste management is currently a major challenge in many developing countries including Malaysia. In urban areas, particularly in the rapidly growing cities and towns, the increase in human population cause an increase in the number of waste products due to human activities. Malaysia is currently facing an increase in municipal solid wastes (MSW) and its management. The MSW accumulation in Malaysia is estimated to increase in 2020 and the largest MSW is made up of biomass materials such as food, paper, and wood. The major component of the MSW is food waste from residential and commercial areas. There is also wastage of organic materials such as products of poultry and agriculture, which occurring both in the commercial and industrial level.

Conversion of organic materials using insects-based system has attracted our attention, especially their ability to process a wide range of organic materials into non-polluting residues. The most potential species useful in this regard is currently the black soldier fly (BSF), *Hermetia illucens*. This species is a non-pest fly, originates from the Southern United State but now has spread throughout the world including tropic and subtropic regions. Adult of *H. illucens* does not possess functional mouthpart thus, do not feed. The adult also do not possess digestive organs, but relying on body fat reserves during the larval stage. This species is not attracted to human habitation and therefore, do not relate to any transmission of vector diseases. Larvae of *H. illucens* are also known as 'latrine' larvae and are naturally found in manure piles of poultry and livestock productions. Larvae of this species have also shown to reduce organic waste efficiently and certainly an ideal solution to transform waste generation into higher value products.

Biology and life cycle of *H. illucens*

Hermetia illucens undergo complete metamorphosis, which include egg, larva, pupa and adult. The adults have a shorter lifespan compared to other fly species, which is around 8 to 12 days. The female of this species can produce an average of 600 eggs per life time. Eggs are oval in shape, creamy white or pale yellow in color and about 1 mm length. These eggs require 4 days before hatching. The complete life cycle lasts approximately 4 weeks to 2 months, depending on the temperature and availability of food. During the last instar larvae, this species turns into pre-pupae and search for drier and cooler places to pupate. The pupae stage takes around two weeks before the emergence of the adult. The adults are sexually mature after 2 days of emergence and mating generally occur during flight. Female of *H. illucens* prefer to lay their eggs in cracks and crevices near the organic material where the larvae able to consume these materials upon hatching.

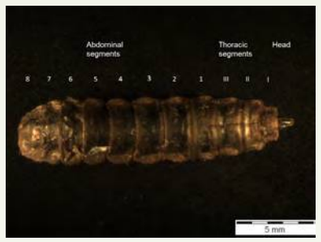
Morphological characteristics of *H. illucens*

The colony of black soldier flies was obtained from Kampung Pokok Tampang, Tasek Gelugor, Pulau Pinang. The larvae of this species were brought back to the Insectarium at Vector Control Research Unit (VCRU), Universiti Sains Malaysia for further rearing and development until the emergence of adults. In our study, the morphological characteristics of immature stages and adult of *H. illucens* were captured using a stereo microscope at Electron Microscopy Unit, School of Biological Sciences, Universiti Sains Malaysia. From the dorsal view, the head capsule of *H. illucens* larvae is narrow and small as compared to the whole body. The body is heavily sclerotized while the head capsule has the ability to be retracted into the chest. Thorax of *H. illucens* larva consisted of 3 segments whereas the abdomen part comprised of 8 segments. The thorax and abdominal segments covered with numerous bristle. There are also spiracles located at the ventral part of the larva, near both the lateral lines. During the pupal stage, the head remains outside and not retracted into the body. The body of *H. illucens* pupae is more opaque compare to the larval stage. The adult stage comprised of important parts such as antenna, frons, compound eyes, wings, halteres and genital structure. The adult possesses 3 pairs of legs with femur and tibia are mostly black, but the basal half of the tibia is white. The abdomen of *H. illucens* adult is long and pale black in color with the second segment consists of a pair of translucent spots. This translucent spot is fully visible dorsoventrally approximately 12 hours after emergence. The genitalia of female comprised of a long pair of 2-segmented cerci whereas the male genitalia consist of enlarged and broadly rounded epandirium with 2 surstyli on each side. The genitalia part of the female is relatively fine compared to the male.

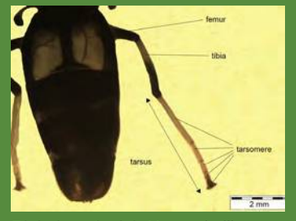
Prospect for organic waste management

The larvae of this species have the potential of converting organic waste. The larvae of this species can feed on a wide range of organic materials from food wastes, animal manures, fruits and vegetable residues to carrion. These larvae are able to reduce the organic materials by consuming and storing it as a protein in their body. However, the reduction rate of organic material by these larvae heavily depend on the size of the larvae and the type of organic waste being consumed. The food wastes that went through larval digestion is considered as fully processed and can be used as compost or for nutritious soil amendment in agriculture. Digestion by black soldier flies larvae help to stabilize the waste, reduces odor emissions as well as prevent the growth of fungal and bacteria. This species also have been proposed to be effective in manure reduction, especially in poultry and livestock productions. Similar to the conversion of food wastes, digested manures are converted into non-polluted end product that can be used to apply to the crops or organic farming. Many problems associated with animal feeding operations and manure mass accumulation has been improved by using *H. illucens*. The concentration of nitrogen, other nutrient contents and odour of manures are also reduced and thus, further reducing the potential of pollution. The development of waste treatment facilities using black soldier flies could offer several advantages. This facility can be operated at an affordable cost (buildings and maintenance) and independent from power supply, thus, possibly adapted to the economic potential of developing countries such as Malaysia. Finally, the pre-pupae stage of *H. illucens* are subsequently harvested as animal feeds. This nutritious feed is a good source of oil and protein for poultry, livestock and aquaculture. This serves as an alternative protein sources to these animals and can be commercialized either as a fresh or dried pupae meal. In response to the problem of managing organic waste, the bioconversion technology of MSW using the larvae of black soldier flies is the most promising in generating non-polluted residues and also therefore, economic value products.

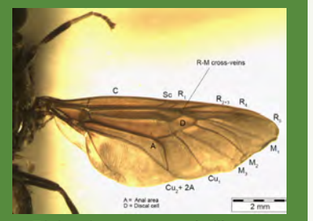
Dorsal view of larvae *Hermetia illucens.*



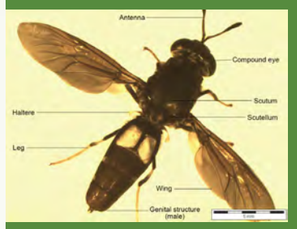
Dorsal view of pupae *Hermetia illucens.*



Right leg of adult *Hermetia illucens.*



Right wing of *Hermetia illucens.*



Dorsal view of adult *Hermetia illucens.*

Comparison between female and male genitalia of adult *Hermetia illucens.*

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Mosquitoes invading Mangrove Forest; the effect to the ecosystem and human population

Tengku Nur Saffawati Tengku Ismail and Nur Faeza Abu Kassim

Mangrove in Malaysia is an ecological niche between the land and sea that serve to protect the land from storm surge and soil erosion. Despite of its mangal terrain, the diversity of its fauna species is vastly extensive. Amidst all ecologically beneficial species, the presence of mosquitoes in mangroves are regarded as a threat to humankind, although the risk itself is insignificant. Mosquitoes in the mangroves play a role in the ecological balance therefore they might pose a similar threat as a vector in comparison to mosquitoes in the urban or rural areas.

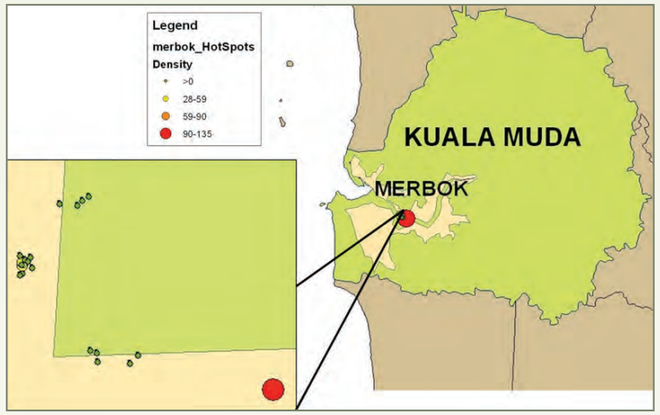

Figure 6: Hotspot for Mosquitoes Area.

Ongoing research

The current research on mosquitoes in mangrove is conducted in mangrove areas of the Northern part of Peninsular Malaysia; Matang Reserve Mangrove Forest, Merbok Mangrove Forest, and Balik Pulau mangrove areas. The study areas were categorized into two sites, which are disturbed and less disturbed areas. The preposition is that disturbed areas are closer to human establishment or an area, which has a definite presence of artificial containers such as plastic bottles, or tyres that increase the probability of mosquitoes breeding sites. The sampling methods used to sample the mosquitoes varies from larvae and adult such as using standard pint dipper to sample larvae in brackish pools, oviposition trap (ovitrap) placement and using a pipette to sample mosquito larvae from tree hole or other artificial containers.

Meanwhile, the adults are collected by using bare leg catch (BLC) techniques and using aspirators to collect resting adults in crab burrows. All the mosquitoes are identified using mosquitos' identification keys from Ratttanathikul (1982) and Jeffery *et al.* (2012). The focus of the study is to document the mosquitos' species in mangrove forests, as there is a lack of information on the mosquitoes of mangrove forests in Malaysia. The results will also be used to predict the spread of mosquito-borne diseases, especially around mangrove areas by using Geographical Information System (GIS).

Mosquitoes in mangrove

Water source is an important aspect in the life cycle of mosquito as they undergo three quarters of their life cycle in the water from egg to larva and pupa before emerging as an adult's mosquitoes. In addition, pertinent to this condition, the environment of mangrove forests is genuinely suitable for mosquitoes breeding sites, as there are many water resources from the saltwater or rainwater. Past studies had shown the favourite breeding sources of mosquitoes in mangrove forests, which are tree holes, crab burrows, water pools, and artificial containers. Significantly, the abundance of mosquitos' species in the mangrove is due to accessible water sources and suitable environment such as high humidity, low temperature, and shaded areas. These conditions allow the mosquitoes

Figure 1: The team members in Merbok Mangrove Forest, Kedah.

maximize the breeding capacity and consequently increases the number of mosquitoes in mangrove or others forested areas. Also, in contrast to popular beliefs that mosquitoes could not oviposit or lay eggs in brackish water or salt water, recent studies discover that *Aedes albopictus* and *Aedes aegypti* can lay eggs in brackish water up to 14 parts per thousands (ppt) salinity. While the salinity readings of the seawater can range between 30ppt and above, the salinity range of areas from the estuary are between 8 ppt to 20 ppt. Thus, there is a high probability for the mosquitoes to breed and oviposit in the estuary depending on the tidal inundation and rainy season. According to previous research, species diversification in mangrove mosquitoes varied highly and have different preferred habitats although they breed in the same environment. For example, *Aedes albopictus* prefers to breed in artificial containers while *Aedes aegypti* prefers tree holes as breeding sites. There are also a few non-vectors species such as *Mansonia* and *Anopheles* species that was found in mangrove forests especially in natural breeding sources. Other species found in mangrove in Malaysia also include *Aedes butleri, Aedes niveus, Toxorhynchites brevipalpis* and *Culex sitiens.*

Figure 2: Aquatic plantation as one of mosquito breeding sites in mangrove forest.

Figure 3: Breeding site of mosquitoes with high organic contents.

Figure 4: Suctioning technique of tree holes for natural breeding sites.

Forecasting mosquitoes borne diseases in mangrove areas

Due to the uprising of developments in Malaysia, the risks of spreading mosquito-borne diseases in new developed areas are high. According to the land use records, the developed areas in Malaysia involve residential, commercials, industrials, and institutional zones. The human dwelling areas that will be developed near and probably in the mangrove forests will be disturbing the habitats of the mosquitoes in the areas. Hence, the invasions of mosquitoes and the outbreak of mosquitoes-borne diseases will occur. The importance of detailed documentation of mosquitoes in mangrove forests is important to the developers and researchers. The researchers would have to come up with a new idea to suppress the distribution of mosquitoes in the areas that will be developed or finding another approach in attempt to remove the mosquito breeding sources. Both objectives are viewed from managerial or scientific causes. Unlike Australia or United States of America, the mangrove areas in Malaysia are yet to be developed, thus there are few mosquito control methods that are being used there that can be applied in Malaysia. The idea of creating buffer zones between the human development area and adjacent mosquitos' habitation sites currently applied in those countries together with pre-treatment of wastewater to reduce potential breeding habitats of mosquitoes. The health management of vectors is not something to be taken lightly as the total annihilation of mosquitoes and other vectors is not possible anywhere near the future. To conclude, only by knowing the biology and ecology of the species can we find the measure to control it and by researching the mosquitoes in mangrove forests can we estimate the ways to control its distribution.

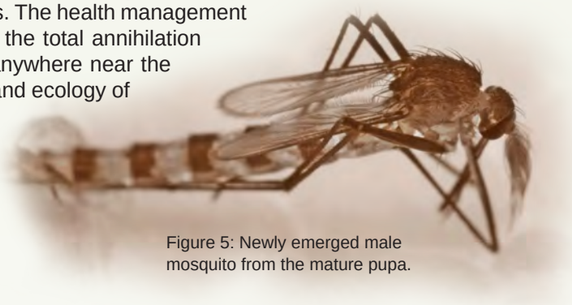

Figure 5: Newly emerged male mosquito from the mature pupa.

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Mosquitoes:

Are they all that bad?

Nur Iwani Jalaluddin and Intan Haslina Ishak

A tiny and ubiquitous flying insect which frequently surrounds us either day or night, frightened by many, is none other than mosquitoes. Mosquito is an insect which consists of approximately 4500 species worldwide. In Peninsular Malaysia, there are 376 species of mosquitoes. All of which have different preferences in breeding and resting habitats. In our daily life, we will encounter mosquitoes which, either have black and white stripes or have brown coloured scales.

As we discover more about mosquitoes of different species, we found out that the mosquito is not necessarily a nuisance to our daily activities, but somehow there is a positive side to their existence, and we could see that they are also a beautiful creature of God. Despite being labelled as the deadliest animal on earth, mosquitoes do have roles in balancing our ecosystem. Some of them also exhibit unique morphological characteristics. For example, the *Toxorhynchites* mosquito is also commonly known as elephant mosquito due to its large body size. It is also recorded as one of the natural predators of *Aedes* sp. due to its capability in killing the immature stage of *Aedes* mosquito, especially at their larval stages.

The colocasia axil is the breeding site for *Malaya genurostris*.

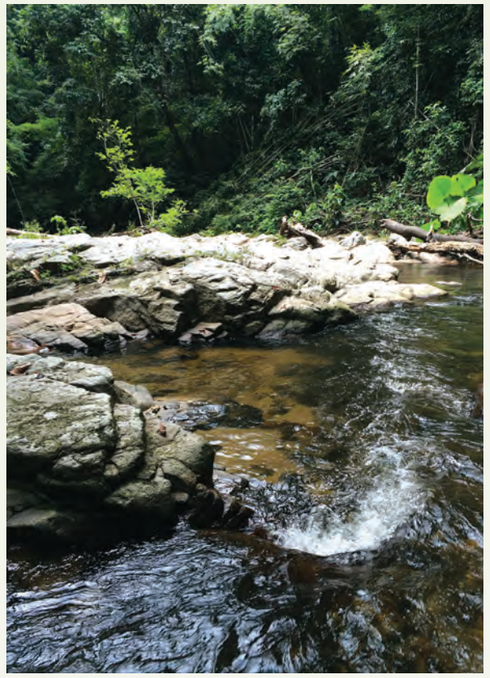
The mosquito diversity in different ecological systems such as in urban, rural areas, oil-palm plantations and state park forest were conducted by our research group from the year of 2014 until 2016. The purpose of the research was to determine the species composition and diversity of mosquitoes at different level of ecological systems and to characterize their role as vectors in our community.

The mosquito species abundance varies greatly based on their habitat. In urban and sub-urban areas of Penang Island, the most frequently encountered mosquito species are *Aedes aegypti* and *Aedes albopictus.* The *Aedes aegypti* has a distinct behaviour compared to *Aedes albopictus*. Besides being an anthropophilic mosquito, *Aedes aegypti* has demonstrated an endophilic behaviour which makes them commonly found in densely packed human areas. The endophilic behaviour of *Aedes aegypti* makes the rearing process in the laboratory much easier due to their higher adaptability in breeding indoor compared to *Aedes albopictus*. Regarded as a secondary vector of dengue virus, *Aedes albopictus* has rapidly expanded its distribution across the temperate and tropical regions. The female of *Aedes albopictus* is exophagic and exophilic. It tends to bite on various vertebrates, ranging from mammals to avians living outdoors.

In the rural areas such as in remote villages and areas where the forest is converted into oil palm plantations, the composition of mosquito species is different compared to urban and suburban areas. Among the species of mosquitoes found in these areas are

The man-made well in oil palm plantation is the breeding site for *Culex mimulus*. [LEFT]

Oil palm plantation for mosquito survey. [MIDDLE]



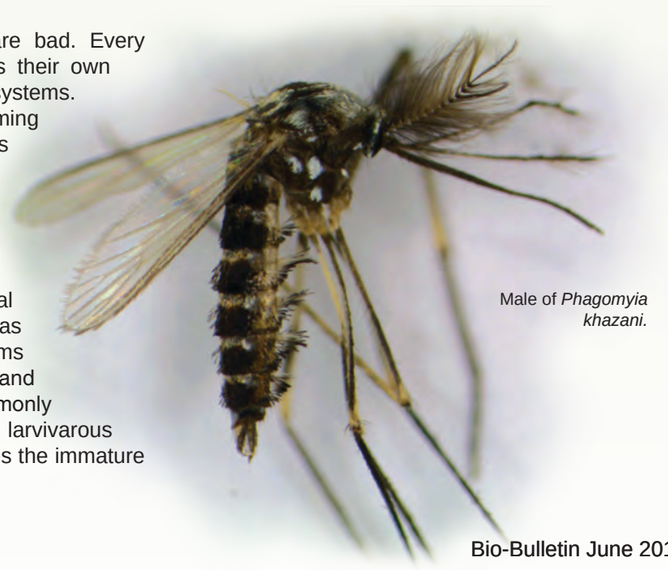
Royal Belum State Park. [RIGHT]

Ae. albopictus, *Culex* spp. and *Toxorhynchites splendens*. It is not surprising that *Ae. albopictus* can be found in these areas as it prefers to rest in shady areas consisting of vegetation. In addition, several *Culex* spp. such as *Culex mimulus* and *Culex tritaeniorhynchus* can also be found in these areas. Based on our research study at an oil palm plantation located in Kedah, the *Cx. mimulus* lives abundantly in a man-made well containing water, while the immature stages of *Cx. tritaeniorhynchus* were found living in the drains containing polluted water located in the village area. The adult feeding behaviour of *Cx. mimulus* is unknown. However, females of *Cx. tritaeniorhynchus* bite on vertebrate animals and also human. Additionally, the adult of *Cx. tritaeniorhynchus* could transmit Japanese encephalitis (JE) virus in most part of Asian countries.

Based on our findings in one of the pristine forest in Malaysia, The Royal Belum State Park in Perak, there are about 17 species of mosquitoes found in natural breeding sites such as tree holes, fallen tree stumps, bamboo stumps, the inflorescence of zingiber and also colocasia axil. The Royal Belum State Park is located within the Belum-Temengor Rainforest and it is regarded as one of the oldest rainforests in the world, older than The Amazon and Congo. Some of the mosquito found in the Royal Belum State Park rainforest such as from the Genus of Zeugnomyia, Tripteroides, Hulecoeteomyia, Phagomyia and Malaya are hardly found in other disturbed forest areas in Malaysia. At their larval stages, the *Zeugnomyia gracilis* would prey on other species of mosquito larvae. In contrast to *Toxorhynchites splendens*, the body size of *Zeugnomyia gracilis* is smaller and the adult female would feed on vertebrates. The immature stages of *Zeugnomyia* sp. can be found inside bamboo stumps. For Genus *Tripteroides*, most of the adult species feed on human and other mammals such as cattle. The mosquito from this genus is also known as a day biter. On top of that, the adult of *Hulecoeteomyia* sp. also bites human. The immature stages of *Hulecoeteomyia* sp. can be found in natural habitats such as in split bamboo and rock pool. Meanwhile, the *Phagomyia khazani* can be considered as the most beautiful amongst all of the mosquitoes found in Royal Belum Rainforest as it has long and prominent hairs on its abdomen. The adult of *Phagomyia* sp. is characterised as human-biting mosquito. The habitat for immature stages of *Phagomyia khazani* can be found in tree holes of highly dense canopy forest. Besides *Phagomyia* sp., the *Malaya* sp. also possesses several unique morphological characteristics. The proboscis of mosquitoes in this genus is swollen, upturned and hairy at the tips. The adult of *Malaya* sp. is a non-hematophagous mosquito. Instead of taking a blood meal, this species will feed on liquid regurgitated by ants. The immature stages of this genus mostly live in colocasia axil.

Based on the prior information, we know that not all of the mosquitoes can be classified as a deadly vector. Many of the hematophagous mosquitoes such as *Zeugnomyia* sp., *Tripteroides* sp., *Hulecoeteomyia* sp. and *Phagomyia* sp. are not a vector of any diseases in spite of their behaviour as a blood-feeding insect. There are also non-hematophagous mosquitoes such as *Malaya genurostris* and *Tx. splendens* that does not have any importance either in medical or economy. However, *Toxorhynchites* sp. larvae is a viable species for *Aedes* bio control method.

Hence, not all mosquitoes are bad. Every life stages of mosquitoes has their own role in balancing our ecosystems. For example, by becoming pollinators and food sources for other organisms. The adult mosquito involuntarily carries the pollen while feeding on the flower nectars. In addition, some are important in our ecological systems as they could serve as foods for other living organisms for example fishes, dragonflies and bats. The mosquito-fish or commonly known as *Gambusia affinis* is larvivorous meaning that it could consumes the immature stages of insects particularly mosquitoes. Meanwhile, mammals such as insectivorous bats could consume adult mosquitoes of up to 1000 mosquitoes per hour. Thus, we conclude that mosquitoes do not only bring harmful diseases to the society, instead it is also an important organism in the ecological systems by being one of the food resources to other animals. The technology of genetic engineering may help to stop their role as insect carrying diseases in the future. For example, the wolbachia-infected mosquito could not transmit dengue. The widespread distribution of these wolbachia-infected mosquitoes in our ecosystem would reduce the number of dengue cases in our country.



Male of *Phagomyia khazani.*

Nur Iwani Jalaluddin
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Loach -

Our Unique River Bottom Dweller

M.Z. Khaironizam and A.Z. Zahar

Homaloptera parclitella.

Loaches are very interesting fishes. Some of them are handsomely coloured, and are important as ornamental fishes among the fish aquarist and hobbyist. Some species are also popular delicacies in Japanese restaurant with prices of the cuisines costing up to USD 50 per dish. In some parts of Southeast Asia, loaches are also used as fish bait. Loaches are omnivores and their bottom-facing mouth suited their benthic-scavenging lifestyles. Their food may consist of aquatic invertebrates (worms, micro-crustaceans, insect larvae, etc.), as well as scraps of periphytic algae and organic detritus.

Loaches can be differentiated from the other fishes based on their physical characteristics. This group is characterised by having either a slender body form or worm-liked or anguillid form with a small bottom-facing mouth surrounded with three to six pairs of barbels. Their throat consists of a single row of teeth (pharyngeal teeth – except in Gyrinocheilidae). Some of them possess erectile suborbital spine below the eye which could be exposed or concealed.

Their body size ranges from small to medium (13.5 mm to 120 mm). Most of them are benthic fishes, and can be found in various freshwater habitats such as rivers, streams, lakes, ponds, and peat swamps. They are well distributed throughout Eurasia (Europe and Asia), northern parts of Africa (Morocco and Ethopia) and North America. Currently, they are grouped under the superfamily Cobitoidea of the order Cypriniformes.

Historically, loaches were classified under the superfamily Cyprinoidea. However, the Japanese ichthyologist Dr. Yukio Sawada separated loaches from its sister group, Cyprinoidea. A new superfamily Cobitoidea was formed based on the following osteological characters: 1) the absence of opisthotic bone, 2) the orbito-sphenoid bone connected to the supraethmoid-ethmoid complex, 3) the basibranchial series that is shifted backwards relative to the paired elements, and 4) the presence of ossified second preethmoid. After Dr. Sawada's work, the classification concepts of loaches have been accepted by many fish taxonomists. Currently, eleven families of loaches have been established: Balitoridae, Barbuccidae, Botiidae, Catostomidae, Cobitidae, Ellopostomatidae, Gastromyzontidae, Gyrinocheilidae,Nemacheilidae, Serpenticobitidae, and Vaillantellidae.

Horse-face loach - *Acanthopsis dialuzona.*

Loaches of Peninsular Malaysia

In Peninsular Malaysia, the loaches consist of six families, i.e. Balitoridae, Barbuccidae, Botiidae, Cobitidae, Nemacheilidae and Vaillantellidae, with 30 species known to occur in this region. The most diverse family is Cobitidae with 18 species, followed by Balitoridae (8 species), Nemacheilidae (7 species), Botiidae (3 species), Vaillantellidae (2 species) and Barbuccidae (1 species).

Balitoridae

The **balitorids,** also known as **river or hill-stream or lizard loaches** are wide spread in the Eurasian river systems. They inhabited clear, well oxygenated fast flowing streams. Members of this group generally have elongated, rounded or depressiform bodies, covered by scales. The head is usually flattened or rounded. Pectoral and pelvic fins of some species are enlarged with adhesive or suction pads on ventral surface, oriented horizontally. Pelvic fin with 2 – 7 rays and may be united under the belly. Mouth small, subterminal with 3 pairs of barbels. Currently, there are 15 genera and about 100 nominal species of Balitorids reported from its distributional ranges. In Peninsular Malaysia, 8 species of Balitorid loaches (i.e. *Balitoropsis zollingeri*, *Homaloptera ogilviei*, *H. parclitella, Homalopteroides nebulosus, H. smithi, H. tweediei*, *Neohomaloptera johorensis* and *Pseudohomaloptera leonardi*) have been recorded in the freshwater ecosystems. Members of this family are known as 'ikan puting beliung'.

Barbuccidae

The **barbuccids** are known as the **fire-eyed loaches** as their eyes reflect red colour when exposed to light. Morphologically, these loaches are characterized by having short bodies marked with six vertical barsand covered with scales. Their heads are oval-shaped with dorso-laterally orientated eyes. They have a blunt snout, with the anterior nostril located at the tip of a short tube while the posterior nostril is located at the base of tube and adjacent to eyes. They have small subterminal mouth surrounded with six barbels i.e. 2 pairs of rostral and 1 pair of maxillary barbels. The caudal-fin emarginate; dorsal-fin origin slightly anterior to pelvic-fin origin; pectoral and pelvic fins are orientated laterally, each with only a single simple ray; large tubercles presence on lower flank above anal-fin. This family has a single genus *Barbucca* with two species, *B. diabolica* and *B. elongata* reported from Mekong and Kapuas drainages. In Peninsular Malaysia, only *B. diabolica* was reported from Johor and Terengganu and their Malay name is 'ikan susur batu'.

Botiidae

The **botiids** or **skunk loaches** are characterized by having pointed snouts, small mouths facing the bottom and covered by three pairs of barbels. Their bodies deep and laterally compressed. Most of the species have forked caudal fin and a spine (simple or bifid) anterior to the eyes. These loaches are usually found in slow to moderate flowing streams and standing waters (ponds) with sandy substrate. They usually spend much of their time in crevices or hiding themselves in burrows under rocks or other submerged objects. They are primarily carnivorous fish with foods consists of live small crustaceans, mollusks, insects, worms, and other benthic invertebrates. They occasionally feed on algae and soft aquatic plant. Records of their distribution have been made from the Indus drainage, Ganges-Brahmaputra drainage, Southeast Asia and Eastern Asia (Liao drainage, Japan and Amur drainage). Currently, the botiid loaches consist of 7 genera and 64 species. Three species have been reported in Peninsular Malaysia i.e. *Syncrossus beauforti* (in Golok drainage), *S. hymenophysa* and *Yasuhikotakia morleti* (in Pahang drainage) and their Malay name is 'ikan lali'.

Pangio malayana, P. semicincta and P. piperata.

Cobitidae

The **cobitids** or **true loaches** are the Old World freshwater fishes and their distribution was reported from Eurasia and Morocco. They are characterised by having a single row of pharyngeal (throat) teeth, blunt heads, small and subterminal mouths, three to six pairs of barbels, thin and elongated bodies with some of them having eel-like body forms. Most of the species do not have scales on the body and some of them have spine (simple or bifid) anterior to their eyes. The cobitid loaches inhabit streams, large rivers, lakes and peat swamps. Currently, 21 genera and about 170 species have been reported from its distributional ranges. In Peninsular Malaysia, the cobitid fish is the most diverse group of cobitoids with a total of 19 species from 5 genera i.e. *Aperioptes* (*A. pictorius*), *Acanthopsis* (*A. dialuzona*), *Kottelatlimia* (*K. katik* and *K. pristes*), *Lepidocephalichthys* (*L. furcatus*, *L. hasselti*, *L. tomaculum* and *L. pahangensis*) and *Pangio* (*P. alcoides, P. anguillaris, P. cuneovirgata, P. doriae, P. filinaris, P. malayana, P. muraeniformis, P. oblonga, P. piperata, p. semicincta,* and *P. shelfordii*) present in the freshwater ecosystems. Several species such as *K. katik*, *L. tomaculum*, *L. pahangensis*, *P. alcoides*, *P. filinaris* and *P. malayana* are known only in Peninsular Malaysia. The local name for fishes of the genus Pangio is 'ikan belut' and the rest of the genus is known as 'ikan pasir'.

Nemacheilidae

The **nemacheilids** or **stone loaches** have the widest distributional ranges of all cobitoid loaches. This group of fishes have been found in most of the Eurasian mainland (except south Spain, south and central Italy, northern

Lizard loach - *Homalopteroides smithi.*

part of Scotland, Norway, Sweden, Arctic areas and east of Kolyma River in Russia, Arabian peninsula, Sulawesi, Papua New Guinea and Philippine) and Blue Nile in Ethiopia. This loach forms the biggest family of the cobitoids. To date, 48 genera and about 630 species are known to occur in its distributional ranges. They can be recognised based on their elongated bodies ranging about 3-20 cm in standard length. Their head length is about equal to body depth. They have small subterminal mouths with two pair of rostal barbels and one pair of maxillary barbels. In some species, their suborbital areas have flaplet. The dorsal-fin short with 4 simple and 7-18 branched rays. The nemacheilid loaches inhabit slow to moderate flowing streams with sandy substrates. In Peninsular Malaysia, 5 genera and 7 species (i.e *Acanthocobitis zonalternans*, *Nemacheilus masyae, N. paucimaculatus*, *N. selangoricus*, *Schistura robertsi*, *Speonectes tiomanensis* and *Tuberoschistura baenzigeri* have been reported from freshwater ecosystems. *N. paucimaculatus* and *S. tiomanensis* were only reported from Peninsular Malaysia. Member of this family is known as 'ikan pasir' among the Malays.

Vaillantellidae

Previously, the group of vaillantellid loach was classified under the subfamily Vaillantellinae of the family Cobitidae. The group was hypothesized to be phylogenetically related to nemacheilid and botiid loaches. However, recent evidences from nuclear gene data showed that this group of fish is well separated from other cobitoid fishes. This evidence supported the new classification Vaillantellidae. The vaillantellid loaches can be distinguished from other cobitoid loaches by having; slender, eel-like and laterally compressed bodies. They have long dorsal fin with 58-73 rays and deeply forked caudal fin with upper lobe longer than the lower. Their suborbital spine or lateral ethmoid bones are firmly attached to the skull, not movable and embedded under the skin. They have small subterminal mouth with one pair of maxillary barbels and 2 pairs of rostral barbels united at the base. Only two species of vaillantellid loaches were reported to occur in Peninsular Malaysia river systems i.e. *V. euepiptera* and *V. maassi*, locally known as 'ikan belut'.

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The Duskies around us - introducing

Langur Project Penang (LPP)

Joleen Yap and Nadine Ruppert

Talking about primates on Penang Island, most Penangites are familiar with the mischievous grey colored Long-tailed Macaques (*Macaca fascicularis*) that can be seen in various habitats, such as forested areas, residential neighborhoods, gardens, and nature parks. However, many people don't know about the existence of one unique primate species that we can find just in our backyards, the Spectacled Langurs or Dusky Leaf Monkeys (*Trachypithecus obscurus*).

I remembered about asking an Uncle, who never missed a daily morning hike in Cherok To'kun Bukit Mertajam, about the occurrence of langurs around the area. He told me: "There used to be so many of them here! Right now, my grandchildren don't even know that these primates exist in the wild!" This is the sad truth nowadays: with the rise of urban development most people are failing to achieve better nature conservation efforts and aren't even aware of it. As a Penangite, I have always been fascinated by the biodiversity in Penang, especially of primates, thus my passion encouraged me to start a Master research project with USM, which is all about the langurs*:* Langur Project Penang (LPP).

The Langur Project Penang (LPP) is a research project that studies the ecology and behavior of the Dusky Leaf Monkeys (*Trachypithecus obscurus*) found in Penang. Commonly known as langurs, lotong or lutong, the dusky leaf monkeys are widely distributed from Southern Burma to Peninsular Malaysia. Found mostly in closed primary forests, dusky leaf monkeys are arboreal (live in trees) and folivorous (eat leaves), although they also feed on certain fruits, flowers and young shoots. For this reason, the dusky leaf monkey plays a pivotal role in forest regeneration, as seed dispersers. In many countries, primates are part of the natural and cultural heritage, with immense importance. In the Hindu religion, for example, the God Hanuman is depicted as a monkey, and the most widespread langurs of South Asia, the Grey Langurs (genus *Semnopithecus*) are also known as Hanuman Langurs.

In Penang, increasing deforestation for land development caused tremendous habitat loss driving the dusky leaf monkeys out of their natural

habitat and forcing them to move closer to human populated areas. As a food source becomes scarce, they are forced to migrate across forest fragments, which makes them prone to road accidents and attacks by other animals.

Although people often mean them well, feeding these primates is highly discouraged. The reason being that feeding them will alter their behavior (i.e. inducing dependency on food handouts and increasing aggressiveness within and between groups, and leading to human-primate conflicts). Human-primate interactions can also lead to disease transfer on both sides and at most times, the food isn't suitable for the primate and can lead to severe illness.

Apart from deforestation, another huge threat to the dusky leaf monkeys is poached for the illegal wildlife trade that is happening rampantly around us. The high demand for exotic pets that are even advertised on social media has caused a high number of deaths of these primates. When the poachers try to get hold of one baby, often they annihilate the entire family. The baby often does not survive the first weeks in captivity as these primates have a specialized diet and do not live long under human "care".

Due to all these facts, the LPP has positioned itself as a community education and outreach project under the umbrella of the Malaysian Primatology Society (MPS). In collaboration with governmental bodies (such as the Wildlife Department), educational institutions and other NGOs in Malaysia, LPP aims to serve as a platform for long-term environmental research and education on primates for local students and the Penang community.

We have only started a year ago. This year has been very successful. LPP members have been invited for numerous public talks in schools around Penang to create awareness of langurs. I was invited as a keynote speaker at the 9th International Student-Based Conference 2016 (ISBC) at INTI College. I also presented my research findings at the Seminar Ekologi Malaysia (SEM16) at UKM. Together with my supervisor, Dr, Nadine Ruppert, we expanded the LPP network at the Khazanah Global Lectures at Kuala Lumpur Convention Centre, where we met Jane Goodall. One of the highlights of this year was our public educational workshop with an art and photography exhibition organized at the Tropical Spice Garden in September.

On 10th September 2016, LPP successfully conducted a public event in primate education and conservation awareness entitled, "Penang LaoGao, Monkeys!". The aim of the workshop was to educate the public of all ages on admiration of our local wildlife and to introduce LPP as a community outreach project. Instead of just giving educational talks, we incorporated art, photography and videography into the event displaying a series of contributions from LPP's volunteers and artists.

The event started off with an ice breaking game on guessing the calls of some common animals on Penang Island, from the langur to the White-bellied Sea Eagle (*Haliaeetus leucogaster*), Asian Koel (*Eudynamys scolopaceus*) and Plantain Squirrel (*Callosciurus notatus*). Surprisingly, only very few people in the audience recognized some of the calls. The majority of the audience is unaware of the sounds by the wildlife resident living around them.

Dr Nadine then presented her talk introducing the diverse primates of Malaysia. The crowd was thrilled to learn about the critically endangered Bornean Orangutan (*Pongo pygmaeus*), the big-eyed Horsfield's Tarsier (*Cephalopachus bancanus*), the Sunda Slow Loris (*Nycticebus coucang*) and many more. Dr Nadine also elaborated on the importance of primates in maintaining forest regeneration, threats that all primates are facing (habitat loss & illegal wildlife trade) and some inspiration from her own research, the *Macaca Nemestrina* Project, where she studies the Southern Pig-tailed Macaques at the Melintang Segari Forest Reserve, Perak.

To keep the momentum going, I continued with the LPP talk. I shared my research prospects and outcomes also showing various interesting videos and photos about my research journey with the langurs to the crowd. I also encouraged the public to be more involved in wildlife conservation and research, highlighting that they don't have to be an official scholar, student, researcher or educator to contribute. The main message was to think outside of the box and look at the world from different perspectives where we all can do our part as individuals to help our natural environment and animals. For example, from voices to voices (education through conversation) and actions (e.g. by art, videography and photography), we can help people to understand the importance of protecting the forested areas in Penang for our natural residents. We can do our part as a responsible citizen by reporting any related wildlife crime (illegal pet and animal parts trade) to the authorities (Department of Wildlife and National Parks, PERHILITAN). Most importantly, we should not be involved in any wildlife cruelty and consumption of wildlife animal parts.

After the talks, we engaged the crowd in a community activity where we all wrote messages regarding the environment onto dry ficus leaves, to "Leaf a message". The leaves were then glued on a langur illustration on a big manila card. "Protect the forest, save the animals", "Deforestation doesn't solve problems, but creates more", "*To a greener, nicer and safer Penang*" and "*Langurs need our help, stop deforestation*" were amongst the messages written by our participants during this activity. It was so inspiring to see the passion and concern of the public towards the development on Penang Island. We all have the same hope that our voices will be heard.

The final part of the event was an exhibition and networking sharing session, where we had 20 pieces of langur photographs, 15 pieces of art projects and 5 videos contributed by volunteers for this beautiful event. Furthermore, we had a great time exchanging ideas with people from different backgrounds.

LPP is looking forward to continue playing a vital role as a voice for the dusky leaf monkeys. The LPP will be involved in matters related to the conservation of their habitat, putting a stop to illegal wildlife trade as well as to set up a platform for research, conservation and education.

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Figs: The Holy Fruit

Tan Li Vern and Dr. Chew Bee Lynn

Freshly harvested fig fruits.

In Malaysia, figs are more commonly known by their Arabic term, buah tin which was adapted from the first verse of Surah at-Tin in the Quran '*Demi buah ara dan zaitun* (Quran, 95:1). This denotes that all of God's (Allah SWT) creations has benefits and uses to it, whereby no creations are deemed worthless or without meaning. The Prophet Mohammed (SAW) was also quoted saying, ''if I could wish a fruit brought to paradise it would certainly be the fig'' and was distributing figs among his followers saying: "Eat it as it cures various diseases", indicating that figs have vast medicinal values. Common figs belong to the Moraceae. Its leaves are palmately shaped with lobes ranging from 3-7 cm with a fair amount of trichomes, making them thick and hairy. The "fruit" in correct botanical terms is called a synconium, a false fruit which houses many flowers on its insides. Figs come in many different shapes, from obovoid, turbinate, or even pear-shaped, and in different colours ranging from yellowish-green to dark-purple, except for the Panache variety which has fruits of green and yellow stripes.

The ability of figs to cure many diseases comes from the high levels of nutrients it contains namely calcium, potassium, iron and other inorganic salts. Good news is they are also fat and cholesterol free. Interestingly, figs also contain high amounts of phenolic compounds which are heavily correlated with high antioxidant activity, even more than red wine and tea which are known for their high phenol levels. Figs have fibre content which is much higher than any other common fruit, vegetable or nut. Fig consumption can help with constipation and gastrointestinal problems and also weight loss.

Figs were said to be native of the Western Asia region and were slowly distributed by man throughout the Mediterranean region and now to many parts of the world. The cultivation of figs were said to have predated barley, wheat, and legumes in terms of crops of early agriculture. Production of figs is now dominated by countries of the Mediterranean region such as Turkey, Egypt and Algeria. It is of no doubt that figs grow best there, producing high quality fruits, thanks to the dry warm-temperate climate that figs are accustomed to. However, figs are very adaptable species, allowing them to grow almost anywhere such as in America and in the European region such as France and Italy and now, in Malaysia. All the plant really needs is fertile soil with good drainage. However, the heavy downpour in tropical climate is a huge adversary to figs. Rain hinges proper fruit development by causing the fruits to split but with proper care, figs can grow well in wetter, cooler areas like here in Malaysia.

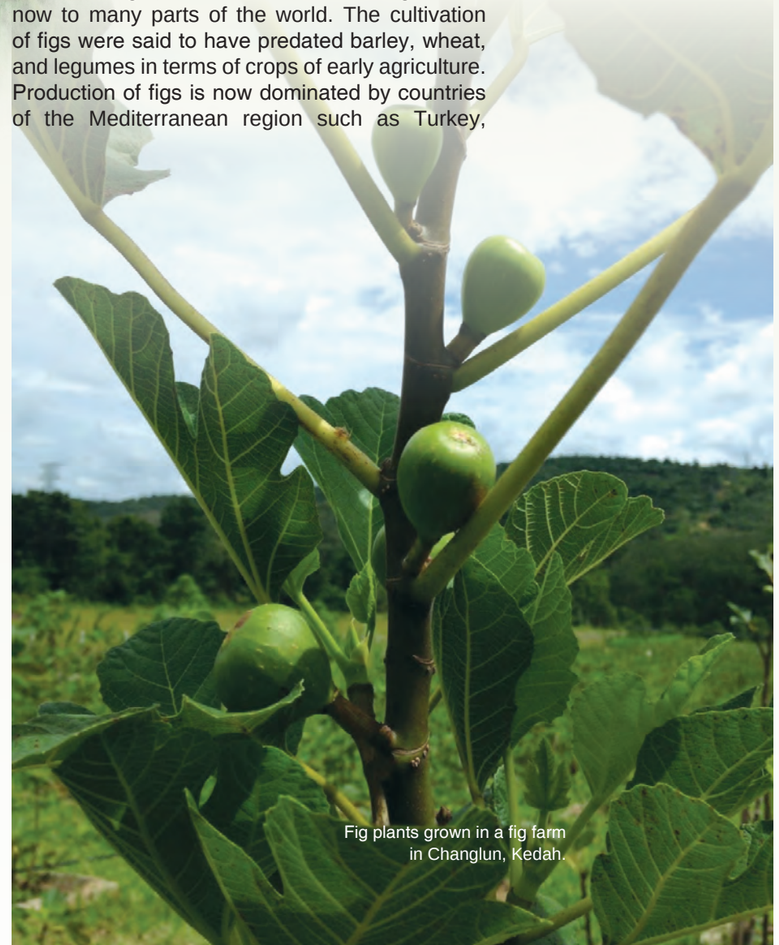

Fig plants grown in a fig farm in Changlun, Kedah.

Tissue culture grown fig plant.

Fig plantlet after being acclimatized for 8 weeks.

Figs are still new in Malaysia and are being imported at a high price (approximately RM80.00 per kilogram) as it is not commercially grown in Malaysia for local consumption. The current propagation methods for fig plants still mainly rely on cuttings, grafting and air layer which can be inefficient. These methods do not yield consistent growth and production of fruits which indirectly causes inconsistency in fruit harvesting for a commercial scale market. On the other hand, propagation via seeds is not an efficient method as well, as progenies from seeds do not have similar traits as parent plants.

Micropropagation *via* plant tissue culture is a reliable and adaptable *in vitro* method in mass plant propagation. The method produces consistent and faster rate yielding clones of parents from novel varieties. Explants from totipotent parts of the plant can be excised and grown *in vitro* which allows manipulation of media formulations and plant hormones at controlled conditions. This will induce large numbers of fig plantlets which later could be used to grow in the Malaysian fields, for the establishment of fig plantations leading to quality and consistent fig production for the Malaysian market. Currently, Dr. Chew Bee Lynn and her team of researchers are working on optimizing the best micropropagation techniques of robust fig varieties such as Texas Everbearing, Black Jack, Violette De Solliès and Panache, paving way for mass production of fig plantlets that can fullfill the increasing market demand.

Dr. Chew Bee Lynn is a Senior Lecturer at the School of Biological Sciences, Universiti Sains Malaysia and researches on the micropropagation of *Ficus carica* via plant tissue culture in collaboration with FigDirect Sdn. Bhd. Tan Li Vern is her PhD student performing studies on the micropropagation of *Ficus carica* in USM.
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Biodiversity of Baling:

The hidden treasure

Nik Ahmad Irwan Izzauddin B. Nik Him, Rahmad Zakaria, Mohd Abdul Muin Md Akil

Baling District is located in Kedah Darul Aman and it is the second largest district in the state of Kedah with an area of 1530 km^2 or 590.32 square miles. It is bordered by Kulim in the south, Thailand and Perak in the east, and Sik and Kuala Muda in the west. In terms of its topography, Baling features many forest plains in its middle region and mountains on the border with Thailand. Baling is surrounded by a dense forest and inhabited by diversity of wild animals. This made Baling one of the unique districts in Kedah. Due to the uniqueness of its animals and plants, a mini expedition was conducted in August 2014 to survey the diversity of forests in Baling. This mini project was led by Dr. Rahmad Zakaria and FRIM officer En. Abu Husin Harun, Dr Nik Ahmad Irwan Izzauddin, Science Officer En. Mohd Abdul Muin and 4 staffs from USM, School of Biological Sciences. This mini expedition also was joined by 2 postgraduate students as a part of their research. We were also accompanied by local villagers as our guide. On the way to the camping site, we were pleasantly shocked to discover the biodiversity richness of the forest even though this place was once opened for the logging industry. Only the abandoned tracks of heavy vehicle and old wood remains can be seen along the way.

As we arrived at the location, all of our wireless technology was useless. No phone signal was available. This is due to the remoteness and isolation of the area which can only be accessed via four wheel drive vehicle. Heavy downpour made our journey quite difficult. Luckily, our experienced driver managed to get us there safely. From the main road of East-West Highway, it took about 45 minutes to reach to the camp site which is situated next to a stream. However, if it rains, the travel time could be more than one hour due to the mud and rising water level. We were very lucky because the camp site was already set up by the local villagers led by Cikgu Azizuddin Abd Hamid (Cikgu Din). During our stay there, Cikgu Din was kind enough to cook our meals. There was not much to be done on the first day as we were tired from the long journey. After having our meal and enjoying the cold river for a swim, we decided to turn in for the night.

On the second day, after breakfast, we began to explore the forest in the hope to achieve our goal – the rafflesia. The local villagers told us that they had seen a flower resembling a rafflesia. The journey to the location took about 1 hour by vehicle. We then needed to walk about 30 minutes to reach the site. We were very lucky to have En Abu (FRIM) to identify the rafflesia species. There was no report on rafflesia from Baling area. We believe that this is a first record of *Rafflesia* in Baling area. Rafflesia is a plant genus, with 16 rare species threaten by extinction. The plant is only found in several locations namely Borneo, Sumatra, Java, Thailand, Peninsular Malaysia and Philippines.

The Rafflesia we encountered in Baling is later identified as *R. kerri*, the biggest species in terms of size of the genus from Peninsular Malaysia. The site where we found the Rafflesia was a post-logging area. Record shown that *R. kerrii* was first reported from Thailand and in Northern Peninsular Malaysia area but none was ever recorded from this site. We believe that the Rafflesia survived not through the environmental concern of the loggers but rather by a lucky chance. The host tree for the Rafflesia are non-commercial value species, thus are spared from the destruction. Rafflesia is a parasitic plant growing on specific host. The host for the Rafflesia is a woody climber (*Tetrastigma leucostaphylum*) from the grape family Vitaceae. In Malay, it is called 'Bunga Pakma' in Peninsular Malaysia with a diameter of 50 to 75 cm. The colour is deep red with many warty spots dotting the petal or perigone lobes (useful for identification process). A few numbers of bud and un-opened Rafflesia are also found growing on the same host. The individual flower that we recorded was at the last stage of blooming. Seven to ten days after blooming, it will start to deteriorate, indicates by the changing colour (red, brown and finally black).

The Refflesia anthetic flower.

Rhizanthes sp. anthetic flower.

On the other side of the camp beside the stream, we were also quite surprised to see a unique plant, *Rhizanthes* sp. which belongs to Rafflesiaceae family. One of the major characteristics of this flower is that there is a series of unicellular hairs but no true ramenta presents on the surface of the ring derivative. Generaly *Rhizanthes* sp. is often found in close vicinity to the *Rafflesia. Rhizanthes* does not possess a floral chamber like the *Rafflesia* but does exhibit expansion of the ring structure. The ring forms a series of pads that are congenitally fused to the adaxial surface of the perianth lobes.

During the second day, all of us had a chance to explore the nearby limestone hill and cave. Overall, it took about 45 minutes to reach the cave. En Mohd Abdul Muin (Science Officer) was interested to look for lizards or snakes that might be present along the trail and at the limestone hill. Also known as Gunung Pong-pong by the locals, the area surrounding this majestic limestone karst was spared from logging due to its steepness. Although not too high, the vegetation on top of this hill is unique compared to other limestone karsts in Malaysia. The animals and plants living on limestone karst are well known for its endemism. This is the main factor that attracts us to visit the area.

Amongst the crevices and cracks of the limestone formations, En Mohd Abdul Muin found at least four individual of round eyed gecko, *Cnemaspis* sp. Unfortunately, he was unable to catch it due its skittish nature during daytime. This species is putatively considered as new but remained unconfirmed until a specimen can be obtained. There was also a beautiful Blue-necked Skink, *Sphenomorphus cyanolaemus*, which is quite rare in Peninsular Malaysia compared to Borneo. This species has only been recorded from a few localities such as Bukit Rengit (Pahang), Bukit Larut (Perak), and Kepong (Selangor). A nocturnal herping (herpetologists sampling) session was thwarted by heavy rain during the three nights stay there.

Along the journey towards Gunung Pong-pong, a lot of interesting insects were observed. For example, a unique and colourful lantern bug of *Pyrops* sp. The unique characteristic lies in the elongated forehead or nose with colorful tips (they are not lanterns as the name suggests). Encik Mohd Abdul Muin also managed to capture a highly venomous Striped Coral Snake, *Calliophis intestinalis*, while it was trying to cross the logging track.

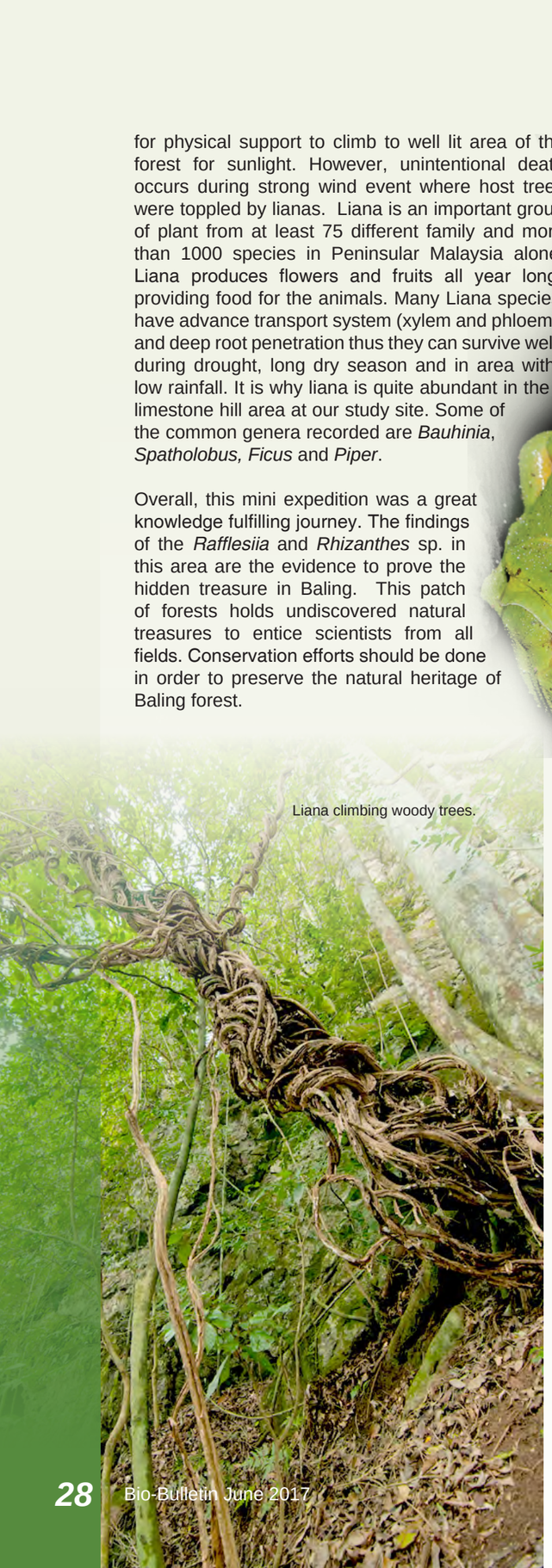
Lantern bug, *Pyrops* sp.

The trail to the top of Gunung Pong-pong is blessed with high diversity of Liana (climbing woody trees). 'Liana' is not a proper scientific classification, instead, it is a term used to climbing plants. Liana are actually woody plants that stay rooted to the ground at all time. Their morphologies change only after being attached to a host plant. Liana does not obtain nutrient, water or food from their host; they depend on their host

for physical support to climb to well lit area of the forest for sunlight. However, unintentional death occurs during strong wind event where host trees were toppled by lianas. Liana is an important group of plant from at least 75 different family and more than 1000 species in Peninsular Malaysia alone. Liana produces flowers and fruits all year long, providing food for the animals. Many Liana species have advance transport system (xylem and phloem) and deep root penetration thus they can survive well during drought, long dry season and in area with low rainfall. It is why liana is quite abundant in the limestone hill area at our study site. Some of the common genera recorded are *Bauhinia*, *Spatholobus, Ficus* and *Piper*.

Overall, this mini expedition was a great knowledge fulfilling journey. The findings of the *Rafflesiia* and *Rhizanthes* sp. in this area are the evidence to prove the hidden treasure in Baling. This patch of forests holds undiscovered natural treasures to entice scientists from all fields. Conservation efforts should be done in order to preserve the natural heritage of Baling forest.

Rhacophorus nigropalmatus, Wallace's Flying Frog.



Liana climbing woody trees.

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Mr. Mohd Abdul Muin Md Akil is a graduate in Zoology. Currently he is pursuing his MSc in herpetology. Other than herpetology, he is also involved in many ornithology and mammals research. He also loves nature photography.

Take-home tips on how to

Communicate to the Media

Dr. Nethia Mohana Kumaran

Have you experienced sweaty palms, coming down with shaking leg syndrome, feel like you have thousand butterflies flying in your stomach (let's blame it on the autonomic nervous system which have no control of), your head spinning, and your lips locked when you are asked questions during an interview? Well, you are not alone. As academicians and research scientists, we would experience these feelings more than once when we face the media.

I recently attended a Science Journalism workshop at the Academy of Sciences Malaysia organized by MIGHT, the British Council and the Young Scientists Network – Academy Science Malaysia (YSN-ASM). The workshop is part of the Science Communications Program under the Newton-Ungku Omar Fund (NUOF). The workshop was facilitated by Sally Stevens and Vicky Lucas, two brilliant and cheerful facilators from the Institute for Environmental Analytics, UK.

The aim of the three day course was to bring together journalists, tv anchors, producers, science communication personnel and scientists to meet and share their experiences and tips on how to communicate and write effectively to the media to showcase our scientific findings.

During one of the sessions, journalists and other media personnel shared some tips that researchers could follow and practice before facing an interviewer.

Don't be afraid of using different languages
(*Example:* When you are answering a question in English, switch to another language (e.g. Bahasa Melayu) if you feel that language would better explain a certain scenario or word definition).

Maintain eye contact
(*Example:* Try not to look elsewhere while addressing a question. Maintain a good eye contact with the interviewer as it also shows your confidence in handling the interview).

It is okay to say that you do not know an answer
(*Example:* It is absolutely OK to say that "I don't know" if you don't know the answers for certain questions. It is advisable to say "I don't know" rather than cooking up an answer which may not make sense or confuse your audience).

It is okay to politely decline to answer
(*Example:* In the event you don't feel comfortable answering a certain question(s), it is allright to politely tell you interviewer that you don't want to answer or comment rather than beating around the bush and not getting to the point. You do not want to repeatedly say Ahhh... ahh...ahh...I think... Well... Your audience would be thinking when is he/she going to answer the question).

Use pictures or infographics
(*Example:* You could use cartoons to explain the work. Pictures paint a thousand words...don't they? It is time we put our drawing skills into practice. You could also ask artists or media to prepare infographics if you think that would help explain your work better).

Well, it was not only the journalists and the media giving us tips and raising concerns. We as scientists, also had our chance to voice out our issues with the media. Some of our concerns were that some interviewers would have done very little homework about ourselves and the scientific endeavors that we embark. Most people from the media agreed that this would normally happen and they would take steps to prevent this (let's wait and see). Some would publish your answers without checking with you and you may find your answers may have been edited and that would have altered the answer which you originally gave. You can request your interviewer to check your answers once the article is prepared or, in some instances ask your interviewer to send you the questions so that you can prepare well ahead.

I hope my brief write-up would have provided you with some take-home tips on how to prepare yourself for a good interview with the media.

Dr. Nethia Mohana Kumaran is a cancer biologist and her research focuses on utilizing the 3-dimensional spheroid model to study the growth, invasion and drug sensitivity of cancer cells. She also utilizes a genetically modified mouse model of melanoma to study the contribution of the apoptosis pathway for melanomagenesis and melanoma drug resistance.
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Advanced Experiental Learning Course

BIOL 3505 Oyster Aquaculture and Restoration Course

Geraldine O Chang and Aileen Tan Shau Hwai

From 13th to 17th June 2016, The School of Biological Sciences of Universiti Sains Malaysia held an 'Advanced Experiential Learning Course' field trip in conjunction with The University of Hong Kong's (HKU) BIOL 3505 Oyster Aquaculture and Restoration Course overseas study trip. A group of 20 students, 3 Science Officers along with Associate Professor Dr. V. Thiyagarajan from The University of Hong Kong attended the 5 day session conducted by Professor Dr. Aileen Tan Shau-Hwai. The course consisted of a progressive series of lectures concerning the state of Oyster aquaculture in Malaysia, as a case study to be brought back to Hong Kong by the students.

Group picture of the organizers in USM and visitors from HKU upon arrival at The School of Biological Sciences, Universiti Sains Malaysia.

School of Biological Sciences Dean, Professor Dr. Amirul Al-Ashraf Abdullah welcomes our visitors from The University of Hong Kong.

Professor Dr. Aileen Tan Shau-Hwai briefing the students on the 5 day course in Penang.

The lectures given touched on plankton culture, the oyster life cycle, harvesting and marketing, as well as the effects of climate change on oyster aquaculture. The HKU students were introduced to the difference in the oyster culture system used in Malaysia, along with the essentials of starting an oyster culture business. Advanced applications in oyster culture, such as the use of triploid oysters for a constant harvest without the issue of 'watery meat' all year round and cryopreservation of oyster gametes as a seed stock solution were also introduced in the 5 day course.

The highlight of the study trip was the visit to Malaysia's first commercial oyster hatchery, SeaHarvest Sdn. Bhd, located in Balik Pulau. The students were introduced to the basics of running a hatchery including plankton cultivation as the main source of oyster larvae feed and the husbandry techniques during settlement and post-settlement stages. Our visitors were most delighted towards the end of the hatchery visit as they were able to feast on freshly harvested raw oysters (and learn about the technology to treat the oysters prior to consumption, a technology not yet applied in Hong Kong) along with an abundance of tropical fruits that were in season such as the durian.

Students enjoying freshly harvested raw oysters at the hatchery in Balik Pulau.

Throughout the course, students were given tasks by groups to tackle application questions that touch on the stark contrast between the oyster businesses in Hong Kong vs. Malaysia which were then presented on the final day and graded for the course.

HKU students in discussion of their impending presentation.

HKU students' group presentation on respective tasks.

HKU students enjoying a karaoke sing-along at the farewell party at the hatchery.

HKU and USM 'oyster' group picture.

We hope more future collaborations with The School of Biological Sciences such as this will take course in the future to facilitate a more personal touch in academic knowledge and cultural exchanges in the field of Biology.

The World Congress of Malacology (WCM 2016)

Geraldine O Chang and Aileen Tan Shau Hwai

The World Congress of Malacology (WCM 2016) is a tri-annual congress and it is also the 19th International Congress of UNITAS MALACOLOGICA (UM). This is only the second time in 54 years that the presidency of UNITAS MALACOLOGICA (UM) has graced the shores of Asia, and the first time in Malaysia. Professor Dr. Aileen Tan Shau-Hwai from the School of Biological Sciences, Universiti Sains Malaysia, is the 19th President of UNITAS MALACOLOGICA (UM) and the first female president in the history of UM.

Together with the School of Biological Sciences, UM hosted WCM 2016 in Hotel Jen, Penang, Malaysia from 18th-24th July 2016. This congress aims to provide a venue for scientists and researchers to share information on the status and recent advances in Molluscan studies and to promote collaboration among scientists, policy makers and young researchers involved in molluscan studies.

Secretariat (in black shirts) at the registration counter.

In total, 284 participants from 40 countries along with 28 secretariat members from School of Biological Sciences, consisting of 7 lecturers, 6 staff and 15 students worked tremendously hard since 2014 to make this event a success. The congress had 15 symposia themes covering a wide spectrum of worldwide molluscan studies such as the Ecology of Marine Mollusc, Integrative Research on Molluscan Phylogenetics and Molluscan Biodiversity and Biogeography in the Indo-West Pacific, to name a few.

The congregation was made up of 35% students and the rest are academicians, researchers and working professionals. A total of 191 Oral presentations and 88 posters were presented throughout the weeklong congress.

Gracing the opening ceremony of the event on 19th July 2016 was YB Datuk Dr. Abu Bakar bin Mohamad Diah, Deputy Minister of the Ministry of Science, Technology and Innovation (MOSTI), Malaysia, Professor Dato' Dr. Ahmad Shukri Mustapa Kamal, Deputy Vice Chancellor of Academics and International Affairs of Universiti Sains Malaysia and Professor Dr. Amirul Al-Ashraf Abdullah, Dean of the School of Biological Sciences, Universiti Sains Malaysia. Professor Dr. Abdul Rahman Mohamed, Deputy Vice Chancellor of Industry and Community Network, University Sains Malaysia was in attendance along with representatives of WCM Sponsors at the Farewell Dinner on 24th July 2016.

YB Datuk Dr. Abu Bakar bin Mohamad Diah's welcoming address at the WCM 2016 Opening Ceremony

Press conference with Mollusc experts: (Left to right) Jesus Troncoso (UNITAS MALACOLOGICA Secretary), Prof. Dr. Zulfigar Yasin (USM), Prof. Dr. Aileen Tan Shau-Hwai (UNITAS MALACOLOGICA President), YB Datuk Dr. Abu Bakar bin Mohamad Diah, En. Mohamad Ridzwan Ishah and Professor Dato' Dr. Ahmad Shukri Mustapa Kamal.

Keynote speakers

Prof. Kathe R. Jensen

Dr. Fred E. Wells

Prof. Dr. Takahiro Asami

Dr. Tony Whitten

Opening ceremony attendees.

Secretariat 'cultural fashion show'.

Participants in costume from the Philippines, Japan and Egypt along with WCM Secretariat.

Prof. Dr. Amirul Al-Ashraf Abdullah, Dean of the School of Biological Sciences, Universiti Sains Malaysia and Prof. Dr. Abdul Rahman Mohamed, Deputy Vice Chancellor of Industry and Community Network at the WCM 2016 Farewell dinner.

Participants at the Farewell Dinner.

Overall, the event was a success and has gotten great feedback from the participants on the high level of professional organization. The 20th WCM will be held in California, USA in 2019.

Footnote: Unitas Malacologica (UM) was founded on 21st September 1962 in London. Before 1998, UM's congresses were only held in Europe, but the 13th UM Congress, held in conjunction with the annual meeting of the American Malacological Union and Western Society of Malacologists marked the first time that the UM Congress has been hosted by a non-European country and thus became the first 'World' Congress of Malacology.

In case you missed it:

Jane Goodall was in town!

Nadine Ruppert

> *If you really want something,*
> *And really work hard,*
> *And take advantage of opportunities*
> *And never give up,*
> *You will find a way.*
>
> - Jane Goodall

For the few Martians amongst you, who do not know Jane Goddall, let me explain first!

Dr Jane Goodall is a world renowned primatologist, ethologist and anthropologist and considered to be the world's foremost expert on chimpanzees. She is the pioneer in primatology and best known for her 55-year study of social and family interactions of wild chimpanzees in Gombe National Park in Tanzania. She is a Dame of the British Empire, UN Messenger of Peace, founder of the Jane Goodall Institute and the international Roots & Shoots program that is also represented in Malaysia (http://rootsandshoots.my). She has worked extensively on conservation and animal welfare issues during the past 35 years and is the role model for many aspiring women in science. At 82-years of age, this fascinating, energetic and inspiring lady is still travelling the world for around 300 days a year to spread the message of hope, peace and youth empowerment to all parts of the planet.

As a little girl who was reading Tarzan, Jane had already dreamed of going to Africa and had always been curious and fascinated by wildlife. In 1957, at the age of only 23 and during a time when it seemed outrageous for women to travel alone. To pursue her dreams of becoming a field researcher far from her home country, she boarded a ship to Africa where she met the famous Louis Leakey, a Kenyan archaeologist and paleontologist. Leakey, impressed with the young, witty Jane, who by that time had no degree or any formal higher education, first hired her as his personal secretary and few years later let her take the lead in studying wild chimpanzees. By that time, chimpanzees had never been observed systematically in the wild and Africa was still known as the "Black Continent", full of enigmas and dangers. With Leakey's two other female protégées, Diane Fossey (gorilla studies) and Birutė Galdikas (orangutan studies), the three became famous as the "Trimates", the first women in primatology who studied all three great ape species.

Dr Jane Goodall during her early research years on wild chimpanzees at Gombe National Park (Picture credit: The Jane Goodall Institute, top and National Geographic, bottom).

Dr Jane at Roots & Shoots event "Reasons for Hope", Berjaya Times Square. (Picture credit: BYouth!)

After touring North America and Hawaii in August and September, last October 2016, Dr Jane came to Malaysia, where she gave a series of talks.

As for many who Jane has inspired ever since, I already felt privileged enough that I was given the chance to see her for the first time live at the Joint ASP-IPS Congress for Primatology in Chicago, 2016. There, she received the lifetime achievement award by the International Primatological Society and delivered the keynote speech during the opening ceremony. By that time, I hadn't dreamt of seeing her twice again, only shortly after that and felt sad for having missed the opportunity to shake hands with her, as the crowds were furiously gathering around her after her talk.

In September, Roots & Shoot Malaysia announced that Dr Jane will come to KL to give a public talk entitled *"Finding Life's Passion"* at Berjaya Hotel Times Square, Kuala Lumpur on Oct 29th. Informing all my students and interested friends, we organized a group of around 20 people who signed up for this event. Already thrilled enough, the good news just got better when Khazanah Global Lectures invited several USM lecturers and students to another talk *"Caring for the Earth: Reasons for Hope" by* Dr Jane, only two days later at KLCC. What a privilege again, now sitting amongst the Sultan of Perak, Dato' Seri Michelle Yeoh and many high-ranking government officials and celebrities, during an exquisite dinner gala to listen to Dr Jane for the third time.

I'll tell you a secret, although she gave nearly the same speech during all three events (of course, when you give talks over 300 days a year!), every time I learnt something new, and my initial fear that it might become boring was ridiculous, as this lady is full of wisdom and wit.

During all her talks, she never failed to emphasis on the important role of her mother Margaret in helping her to become who she is today. Margaret nurtured little Jane's curiosity, even when she went missing for hours to hide in a chicken pen to observe how hens lay eggs, or when she brought earth worms to her bed to have closer look at them. She never scolded her, but encouraged her to dream big, to be brave and bold and never give up. She even took the journey to Africa, year's after Jane first arrived there to assist her with her field studies. As a mother of three I can only hope to become at least a little bit like Margaret one day.

The four most important lessons Dr Jane teaches, her reasons for hope and why we never should give up fighting for a better world, although if times seem desperate; and I cite her own words:

The Human Brain

My first reason for hope stems from our new-found understanding and knowledge of the problems that threaten us and the survival of life on earth as we know it. Surely, then, we can use our minds to find ways to live in harmony with nature. Indeed, millions of people worldwide

Dr Jane at Khazanah Global Lectures (picture credit: malaymail.online).

Aini, Nadine and Joleen meet and greet Dr Jane (2nd from left). (Picture credit: Aini Hasanah)

are beginning to realize that each one of us has a responsibility to the environment and our descendants. *Our actions do matter. We make a difference.*

The Determination of Young People

My second reason for hope lies in the tremendous energy, enthusiasm and commitment of a growing number of youth around the world. As they find out about the environmental and social problems that are now part of their heritage, they want to right those wrongs. They have a vested interest in this fight; it will be their world tomorrow. When young people are informed and empowered, when they realize that what they do truly makes a difference, they can change the world. *They are changing it already.*

The Indomitable Human Spirit

My third reason for hope comes from the power to envision. So many people have set out on seemingly unattainable dreams - and, because of their resolve they have achieved their goals or blazed a path that others could follow. As I travel around the world, I meet so many incredible and amazing human beings. They inspire me. *We inspire those around us.*

The Resilience of Nature

My fourth reason for hope is nature's ability to regenerate itself. Having visited Nagasaki, site of the second atomic bomb that ended World War II, I was able to witness the power of nature. Scientists had predicted that nothing could grow there for at least 30 years. But, amazingly, greenery grew quite quickly. One sapling managed to survive the bombing and today it is a large tree; despite cracks, fissures and a black inside, the tree still sprout leaves! I have seen such renewals time and again, including animal species brought back from the brink of extinction. I carry a leaf from the surviving sapling with me wherever I go.

Let us have faith in our intellect, in ourselves, in our staunch spirit and our ability to progress. Let us develop respect for all living things. Let us replace impatience and intolerance with understanding and compassion. And love. *Let hope be our guide. "* (Jane Goodall)

Jane Goddall's full lecture at Khazanah Global Lectures can be streamed at http://www.kgl.com.my/speakers/jane-goodall.html.

I would like to express my deepest gratitude to Khazanah Nasional, also on behalf of my students Aini Hasanah and Joleen Yap, for inviting us three to this Global Lectures. It surely was a once in a lifetime experience, since we three finally managed to shake hands with our idol.

Nadine Ruppert is a senior lecturer at School of Biological Sciences, USM who studies primates.

Bio-Bulletin

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AUTHORS' GUIDELINES

We, the Editorial Team, would like to invite you to contribute short articles (about 1000-1500 words; 2 to 3 pages of text) for the twice yearly issue of the magazine, the *Bio-Bulletin*, on any biological sciences topic of your interest.

Articles should include at least 3 to 4 good quality color pictures (digital images) along with any tables and figures that can enhance understanding of the subject matter. All figures and tables should be placed at the end of the article, one per page. Photos should be sent as separate jpg or tif files (not embedded within the text). Photos and graphics are very essential to illustrate articles published in *Bio-Bulletin* and should be at the highest resolution possible.

Literature citations are not needed nor encouraged in your article. Please include complete contact information of all authors (designation, email address, affiliation) but the number of authors for each article should not be more than five. Please include a digital photo (face only) of the corresponding author as a separate jpg file. Include a short write-up (not more than 5 sentences) on your area of expertise at the end of your article. There is no fixed text format for submitted articles as all formatting and editing will be done by the Editorial Team.

When adapting your published scientific journal manuscripts for *Bio-Bulletin*, please try to summarize and reword the article using terminology easily comprehensible by the general public. You may include an Author's note at the end of the article giving the full paper citation upon which your article in *Bio-Bulletin* was based so that interested readers can refer to your published paper for more information.

On behalf of the Editorial Team, we thank you for considering this request, and we look forward to receiving your article contributions to *Bio-Bulletin*.

Editor-in-Chief,
Associate Professor Dr Nik Fadzly

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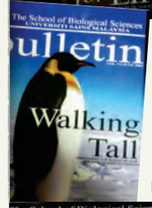

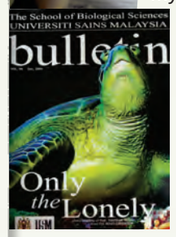

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