

PPPU BULETIN : Special Edition

Asasi Eco Ambassador

CENTRE FOR PRE-UNIVERSITY STUDIES, UNIVERSITI MALAYSIA SARAWAK



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Nurturing Future Scientists...



Since its establishment in 2010, the Centre for Pre-University Studies (CPUS) has been consistently upholding the enculturation of research among our pre-university students by embedding the research components within the foundation curriculum. Realizing the importance of research in the progression of knowledge, our students have been exposed to various research activities, albeit in a relatively smaller scale, designed to complement the foundation programs' curriculum. Biology is one the courses that has successfully integrates the research component in its syllabus whereby students are given the opportunity to explore and learn the rich biodiversity of Sarawak and its surrounding elements in few National Parks located within Kuching such as Kubah National Park, Santubong National Park and Bako National Park. These mini expeditions were planned in such a way as to allow the integral elements of research to be taught and acquired by the students in an enjoyable, interesting and relaxed manner. Basic skills in research such as observation, responding to given tasks or research questions, data collection using prescribed methodology, critical evaluation of the collected data, organizing findings via simple prescribed process, analyzing the findings and communicate these findings via presentations to the audiences are taught by the lecturers who are themselves researchers in their specific fields.

Covid-19 pandemic has inadvertently lead to major changes in the implementation of these research activities. Despite the challenges posed by this unprecedented global catastrophe, the Biology team has innovatively redesigned the field trips in an effort to maintain the research spirit among the foundation students. Taking advantage of the more than 2,200 acres of UNIMAS campus, endowed with rich biodiversity within its perimeter, students are taught the fundamental skills of conducting research in the fieldwork. The hands-on teaching and learning processes that took place during these activities have enriched our students' learning experience and hopefully will contribute to their capacity as life-long learners. Subsequent to these activities, the findings were analyzed, compiled and beautifully presented in this compendium.

Congratulations and thank you to the members of Biology Unit and students who have successfully planned, organized, executed, participated and presented the Eco Ambassador project for all to learn and benefit. It is hoped that this program will continue to be part of the foundation programs curricula and continuously improved to meet the demands of the future.



As a part of the Biology Course curriculum and to gain right understanding on sustainable development and enable to differentiate biodiversity and ecology in different contexts and changes in the environment, the students have been introduced and led to experience biodiversity and ecology and impart to differentiate different components of environment. Therefore, a field work was conducted with the students to experience biodiversity and ecology surrounding the campus. They have analysed and described selected animals and plants by referring to scientific reports from various resources. After the writing, they have presented it in the form of short scientific notes. Experiences of biodiversity, ecology, and environment at pre-university level seemed to be important for the future development of their understanding during the degree level. It is important, both to give the students early experiences of biodiversity and ecology in nature and to take students' early ideas into consideration in academic, research, and development for lifelong learning and for a sustainable future.

The Biology Course is pleased to present, in this issue, the compilation of short scientific notes by the student during the past year 2020/2021. We hope that this publication will both encourage the students to continue spending the commitment of academic production and inspire juniors to follow their example. As in the past years, the write-up has demonstrated the wide variations of biodiversity, ecology, and environment study in various location of national park in Kuching, however, in this issue, you will find the study conducted within the campus area. Nevertheless, the study as far-ranging and divergent as eco-based potential plant for commercial uses, documentation of water quality, rapid wildlife survey, observation of plant-animal interaction, plant-plant interaction, fungi, gymnosperms, angiosperms, pteridophytes, *Nepenthes*, horticulture plant, palm species, medicinal plants, potential threat to ecosystem, and peat-swamp ecosystem. In a word, there is something for all the students.

Mohamad Fhaizal Mohamad Bukhori
Biology Course Coordinator



The pandemic is tough on all of us, and the current circumstances are hard for everyone. Being a student, they may be struggling to cope with COVID-19-related stress. They are probably feeling anxious and uncertain, and feel that is difficult to find ways to or to stay focus as staying at home with family members are sometimes distracting. It is also a very frustrating experience that students can't practice handling laboratory apparatus or even unable to perform face to face lecture session because everything is switch to online mode. That's why, when a simple deed such as turning on webcam during virtual classes to interact with classmates -are truly bless.

Usually, Life Science students will go hiking to any selected National Park (NP) located at Kuching such Kubah NP, Bako NP or Santubong NP. It is one of the student activities that is conducted every year in order to fulfill 10 % contribution to their assessment marks. Unfortunately, due to the pandemic, the plan needs to be changed and Biology lecturers have done their best to bring out similar experience for students to explore even it is only implemented around the Universiti Malaysia Sarawak (UNIMAS) location.

The students were divided into groups and provided with interesting titles of finding. Assigned tasks are super easy, they just have to walk around the location, taking pictures and identifying the right species or entity required based on the title given. Any important information regarding to the finding should be shared. The elaboration and compilation of works are then disclosed in the form of brief manuscripts.

Despite the many hardships that befall, but it does not prevent the students to produce such an excellent outcome. Millions of thanks also dedicated especially to Biology lecturers for the approaches, guidance and reproofs given throughout this Asasi Eco-ambassador, along the run. The pandemic has been tough, but we're ready for what comes next. Hopes for unlocking situation to meet up with the students till then, stay safe!

Norfarahin Norwen
Biology Course Coordinator

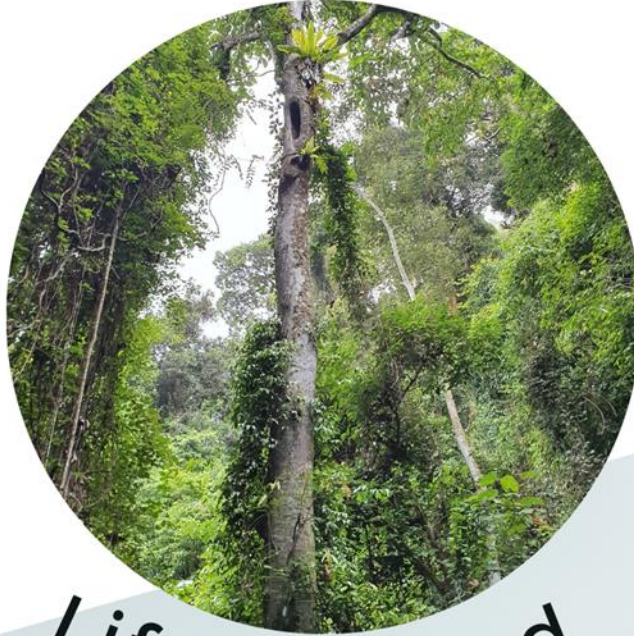
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Life on Land



Designed by Maybelline Goh

RAPID WILDLIFE SURVEY ALONG JALAN KAPUR AND JALAN JATI, UNIMAS CAMPUS

Nur Hazirah Husna binti Jamil, Elvinis Gunong, Nurul Ain binti Azlan Hasni, Ain Hanisah binti Khairul Nizam, Nur Aini Syafwani binti Ahmad, Siti Nur Aisyah Hanim Syakira binti Mohammed Majidi, Ellyana Vicky Foo, Bartholomew Meggau Anak Juelius, Mohammad Sofean bin Subhi, Arllen Joy Albert

A rapid wildlife survey was conducted along Jalan Kapur and Jalan Jati which are in the UNIMAS campus. The objectives of this activity are to determine the types of flora and fauna that can be found in the surveyed location and to apply concepts learned through this activity. Proper observation and analysis are essential during conducting this survey to achieve the objectives. Group members were assigned to observe, monitor, hear, record sound, and capture aesthetic photographs of pitcher plant and some small arthropods. During the activity, several wildlife had been found which includes butterflies, birds, pitcher plants, spiders, lizards, ladybugs, dragonflies, and squirrels. Due to unavoidable limitation in taking photograph of observed wildlife, only several organisms were listed in this article (**Table 1; Figure 1**).

Table 1. The classification organism found along Jalan Kapur and Jalan Jati

Taxonomy	Ladybird	Millipede	Pitcher plant
Kingdom	Animalia	Animalia	Plantae
Phylum/clade	Arthropoda	Arthropoda	Tracheophyta
Class	Insecta	Diplopoda	-
Order	Coleoptera	Polydesmida	Caryophyllales
Family	Coccinellidae	Paradoxosomatidae	Nepenthaceae
Genus	-	<i>Anoplodesmus</i>	<i>Nepenthes</i>
Species	-	-	<i>N. mirabilis</i>

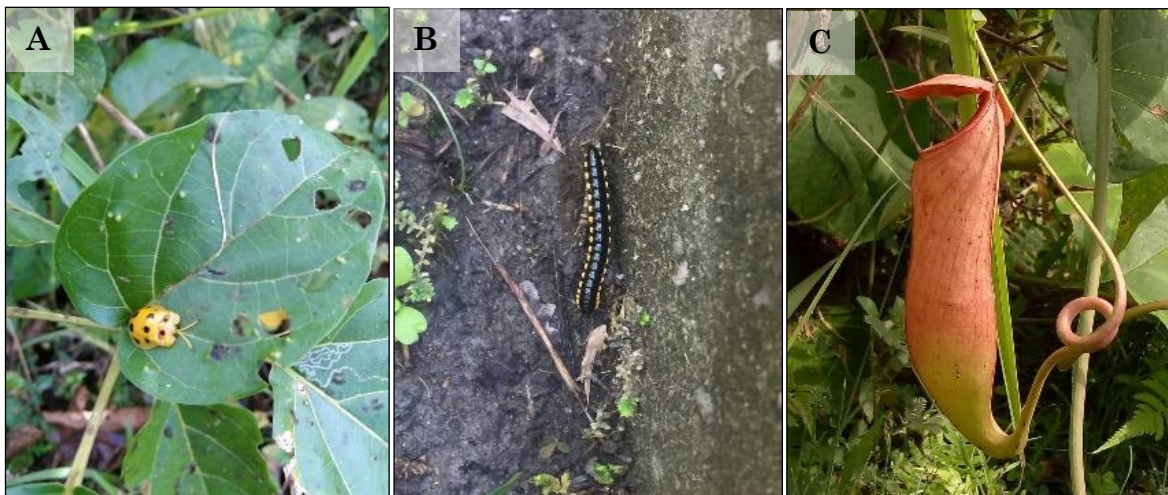


Figure 1. Example of organism found during the survey. **A.** ladybird. **B.** Millipede. **C.** *Nepenthes mirabilis*

In conclusion, these species are crucial components to balance the ecosystem. Insects help to recycle nutrients back into the soil by feeding on dead animals or fallen trees. Plants, especially carnivorous plant help to keep the nature in balance by compensating for the nutrient-starved environment by trapping and digesting insects. Hence, the biodiversity plays a role in boosting ecosystem productivity.

THE OBSERVATION OF PLANT-ANIMAL INTERACTIONS IN UNIMAS CAMPUS

Aisyah binti Muhammad Ihsan, Charlie Yong Chin Yee, Faith Anak Dennis, Johansson Anak Joseph, Muhammad Aliff Naqimie bin Che Azmi, Nur Anisa Aida binti Supian, Nur Jihan Syaza binti Ahmad Ashrin, Nurul Syafiqah Aqasha binti Sahad, Syarfa Afra binti Mohammad Shamsul

Plant-animal interaction exists and interacts in many ways. Plant-animal interactions are crucial for the survival of plants and animals. Examples of plant-animal interactions are predation by carnivorous plants towards animals and mutualism which means both plants and animals will reap the benefit. The objective of this activity is to explore the interaction of plant and animal in UNIMAS campus. The method used is by observing the behavior of animals and the plants involved. Photographs of the animal-plant interactions were taken for records (**Figure 2**). It was observed that a hammerhead flatworm, *Bipalium* sp., found resting on a green leaf. They feed on earthworms by secreting digestive enzymes and absorbing the digested nutrients with its cilia, whereby they can track on their prey via their chemoreceptors. The plants provide shelter and protection to the *Bipalium* sp. from bigger predators and in return, the hammerhead worms aerate and fertilize the soil for the benefit of plants in this tropical area. The red weaver ant, *Oecophylla smaragdina* are found on the tree branch. *O. smaragdina* form colonies with multiple nests on the trees. These ants build their nest by weaving leaves together with larval silk. The tree provide shelter for the red weaver ants as the ants build their nest on the tree. However, the existent of red weaver ants on the tree attacks the small pollinator agents resulted the pollination rates decrease.

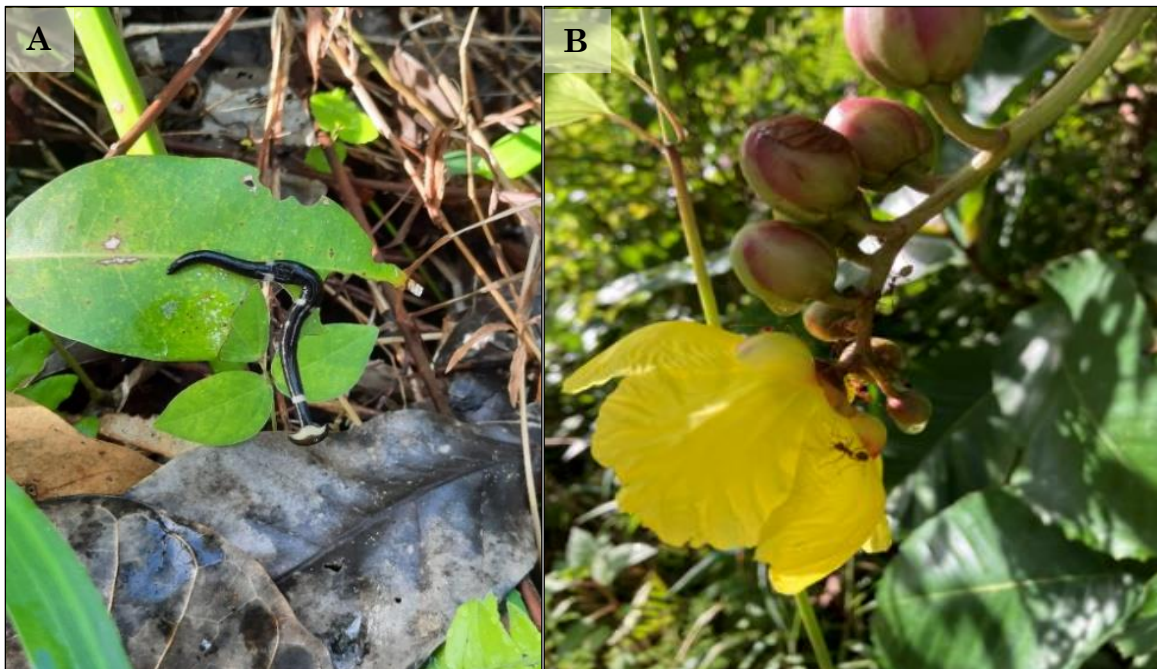


Figure 2. Example of plant-animal interaction in UNIMAS. A. *Bipalium* sp. (Hammerhead worm) with **??**. B. *Oecophylla smaragdina* (weaver ant).

RAPID WILDLIFE SURVEY AT EAST CAMPUS, UNIMAS

Lukman Hakim Hairuddin, Muhammad Harith Noorddin, Eddmiele Frenzzie Emau Edward, Ameline Albert, Nur Syareena Sulaiman, Ummu Azz Zahra Shamsudin, Qistina Dinie Mohd Yahya, Nur Dini Md Ariaaf, Fatulerisha Aziya Setia, Guraverlinda Rose Guncheng.

Universiti Malaysia Sarawak (UNIMAS) are blessed with heritage and surrounded by nature. Learning, and documenting biodiversity, ecology, and environment are relevant and meaningful. Objectives of the activity are to reinforce experiential and contextual learning, to expose students to nature and new environment, and to offer students a unique cultural learning experience. The activity was conducted around East Campus of UNIMAS on rapid wildlife survey around the campus. Photograph of the wildlife were capture followed by identifying the organism by referring to the established reference (**Figure 3**). The activity had recorded *Turnera subulata* which was commonly known as white alder. This flowering plant is under a family of Passifloraceae. It is a well-known species in many other places as an introduced species, such as Malaysia, Indonesia, and United States. It is commonly cultivated as a garden flower. Meanwhile, Longhorn's beetle (Insecta: Cerambycidae) is commonly known invertebrate under subfamily Lamiinae. This beetle has large and diverse group usually found near the host tree, host plant, or dead wood. The activity has offered to broaden information on the existing wildlife in UNIMAS, better understanding of the surrounding wildlife and introduce new learning experience to the students.



Figure 3. Example organism found throughout a short survey. **A.** *Turnera subulata*. **B.** Longhorns beetle.

THE OBSERVATION OF FUNGI IN UNIMAS CAMPUS

Angelina Ak Heroldson, Hamizatulwafaa Bt Abdul Ghani, Hefina Roza Ak Henry, Jerstein Glence Simon Ak Jerry, Mohamad Fitri bin Azri, Muhammad Zikril Hakim bin Ahmad Fuad, Nur Hana Humairah Bt Yusop, Nurfatihah Zulaika Bt Abdul Rahman, Sharifah Zila Syahida Bt Wan Alias

The objectives of this field work activity are to observe the species of fungi that can be found in UNIMAS East Campus while discussing the importance of fungi to the ecosystem. It is also to understand the condition of fungi to live. Fungi play an important role in balancing the ecosystem. Most members of the Kingdom Fungi grow on the forest floor where the dark and damp conditions is rich in decaying plants and animals (**Figure 4**). Their role is to act as decomposers and recyclers. Food web is incomplete without organisms decomposing organic matter. For example, elements such as nitrogen and phosphorus, are required in large quantities but are not available in abundance in the environment. Fungi release these elements from decaying matter and provides them to other living organisms. Trace elements present in low amounts in many habitats are important for growth but would remain in rotting organic matter if fungi do not return them to the environment via their metabolic activity. In short, fungi play a moderately big role in the ecosystem as a recyclers and decomposers. It shows that without fungi there will be defects.



Figure 4. Several fungi species found around the UNIMAS East Campus

THE OBSERVATION OF GYMNOSPERMS IN UNIMAS CAMPUS

Adam bin Akbar Ali, Angelica Lynette binti Amat, Batrisyia binti Md Lazim, Iqmah Syahirah binti Sabry, Izzati Farhana binti Ahmad Zamani, Muhammad Afiq bin Zamawi, Muhammad Danish Haqem bin Mohd Khairi, Nur Sakinah binti Ayum, Roslin Adhwa' binti Roslan

The gymnosperms are group of plants which produce seeds that are not contained within an ovary or fruit. The seeds are exposed to the air and are directly fertilised by pollination (BD Editors, 2017). Gymnosperms are not very common in Malaysia. This is due to its centre of distribution is in the cool temperate zones of the northern and southern hemispheres. An observation in UNIMAS East Campus was done to identify the species of gymnosperm present and its characteristics to be studied. Only one type of gymnosperm was found which is conifer (**Figure 5**). Conifer is in a division of vascular plant containing a single extant class, Pinopsida. They are cone-bearing seed plants, a subset of gymnosperms. This coniferous plant is usually evergreen and have needle-shaped or scale-like leaves, which are heavily cutinised and covered with wax protective coating that slows water vapor loss. Pinophyte reproduce by growing seeds inside of cones. These cones ripen over the course of weeks, and the seeds are then dispersed either by being dropped, eaten, or carried away by forest wildlife. In conclusion, the result indicates that gymnosperm classification is not abundantly found in UNIMAS area for ornamental purposes.



Figure 5. Example of gymnosperm in UNIMAS. **A.** Conifer tree. **B.** Leaves of conifer

Reference

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BORNEAN *Nepenthes* IN UNIMAS

Audrey Jinuin Victor, Eqa Fahiszah binti Madian, Izzuani binti Idres, Matha Munah Stephen, Muhammad Daniel Haikal bin Khairul Faizi, Muhammad Khairi Adam bin Ahmad, Nureen Dhia Batrisyia binti Roslan, Syahmina Safiah binti Syordi, Winnifred Anak James Ajay

An *in-situ* observation on *Nepenthes* was done in UNIMAS East Campus. The main objective was to know more about specific types of *Nepenthes* and its habitat. *Nepenthes*, also known as tropical pitcher plant or monkey cup, is the only genus of carnivorous pitcher plants in the Nepenthaceae family (order Caryophyllales). There are approximately 140 species, the majority of which are native to Madagascar, Southeast Asia, and Australia. The results were obtained by walking through the shrubs to observe and identify species found. Photos of *Nepenthes* were taken with for documenting purposes. Further research was conducted by searching from reliable resources on the Internet. *Nepenthes ampullaria* is unique, among a sea of unique *Nepenthes*. What makes it special is that this lowland tropical pitcher plant produces small, oblong, squat ground pitchers in numerous color of shades (**Figure 6**). It is a detritivore, consuming debris, whereas it eats decomposing plants and animals as well as feces. However, *Nepenthes mirabilis* is an awe-inspiring yet easy going species that naturally grows at a different altitude. It is either grown in mossy areas or even foothills whereby these areas are moist areas. *Nepenthes* is a rare species that is unique in its own habitat and nature. This trip was conducted to introduce the species of *Nepenthes* better to the students as the chance to explore this plant. This activity can also be used as an educational support for others to know better about this species. In that way, this species would be be known widely and it can be conserved for the future.



Figure 6. Examples of *Nepenthes* species in UNIMAS. A. *Nepenthes mirabilis*. B. *Nepenthes ampullaria*

THE OBSERVATION OF MAN-MADE LAKE ECOSYSTEM: WATER LILY (FAMILY: NYMPHAEACEAE) IN UNIMAS LAKE EAST CAMPUS

Marha Madiehah binti Rusli, Nurul Arinah binti Abu Samah, Muhammad Iqbal Haikal bin Rosdi, Azzwin binti Kamis, Nathelbert Banta Anak Sanada, Ummi Zahra' binti Raduan, Nadia bt Noorsazally, Ammar Naszhan bin Mohammad, Farah Sofea binti Ahmad Zaihan

Water lilies are aquatic angiosperms of family Nymphaeaceae and mostly known as ornamental plants in ponds and lakes. They help to purify the water by absorbing nutrients from the water (Reannan, 2018). This short trip aimed to document briefly on the morphology of the water lilies found in UNIMAS Lake East Campus. A 3-hours observation was conducted on one of the man-made lakes on 31st December 2020 and photos were taken for records. Various colours of water lily were observed, among them are pink, white, and purple. Water lilies are one of the most diverse flowers with wide range of colours and they also have a strong fragrance (Tovar, 2020). The flowers tend to last up to four days (Tovar, 2020). Each cuplike flower has a spiral arrangement of its numerous petals (Lotha, 2017). They also have several broad, tapering petals that narrow toward that centre. Petals are curved lengthwise forming a slight channel. The centre has one pistil and is densely packed with bright yellow stamens (**Figure 7**) (Kramer, 2004). Some flowers open only in the morning or in the evening to attract insect pollinators (Lotha, 2017). The various morphological characteristics of the water lilies have contributed to the symbiotic interactions between plants and animals especially in the lake ecosystem.



Figure 7. Variations in water lilies at UNIMAS lakes. **A & B.** Tapering petals that narrows toward centre. **C.** Water lily with bright yellow stamens

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THE OBSERVATION OF HORTICULTURE PLANTS IN UNIMAS CAMPUS

Azmin Nasrin bin Saidin, Corla Jong Yan Ling, Dan Lervia Emmanuel anak Daniel, Grace Elia Basen anak Jackery, Melanie Melvy anak Betong, Musab bin Mohd Narawi, Nur Afeeze binti Arbi, Nurian Shah bin Sudirman, Nusrat Adawiyah binti Nasarudin, Wee Khai Ying,

The term horticulture is defined from the Latin words “Hortus”, a garden and “Cultura”, to cultivate. It defined as the science and art of growing fruits, vegetables, ornamentals, herbs and specialty crops. When science applied to the horticulture industry, it creates different fields which are pomology, olericulture and ornamental horticulture. Based on our findings, the most plants we found were under ornamental horticulture which is floriculture. Floriculture is the area of horticulture associated with the production and use of flowers, potted plants and annual bedding plants. The observation on horticulture plants was done in UNIMAS on the 31st of December 2020. The pictures of the horticulture plants were taken and documented in the campus of UNIMAS using mobile phones and cameras (**Figure 8**). We also looked for the suitable horticulture plant species that suited our criteria by observing the characteristics of the plants that we encountered. Scientifically known as Nymphaeaceae, water lilies are under class of Magnoliopsida. Water lilies are rhizomatous aquatic herbs in temperate and tropical climates around the world. These plants are found in both White House Lake and KFC lake at UNIMAS which parallel to its need of still and shallow freshwater. Due to its fragrance feature, water lilies are extracted to make perfumes and essentials oil. *Strelitzia reginae* or locally called as crane flower and bird of paradise is classed in Magnoliopsida. This plant is famous for its unique resemblance of exotic birds. It is a species of flowering plant indigenous to South Africa and popular in temperate areas as it is an evergreen perennial plant. Due to the iridescent orange and midnight blue flowers, they increase the mood of the surrounding. Their huge leaves are great for air purification and circulation if planted indoor. At Centre for Pre-University Studies (CPUS) UNIMAS, they are discovered at old Food Court which located by the lake, matches to its’ needs of well drainage soil. It has been found that UNIMAS campus consists of many types of horticulture plants which are mostly under floriculture categories. Hence, three examples of horticulture plants were taken for our observation in UNIMAS campus and other information are based on research.

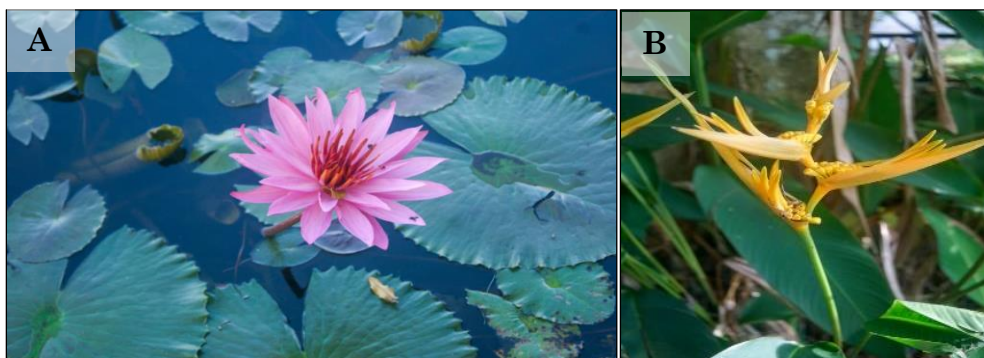


Figure 8. Example of horticulture plants in UNIMAS. **A.** The floating leaves of *Nymphaeaceae*. **B.** Bird of Paradise flower or *Strelitzia reginae*

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RAPID WILDLIFE SURVEY ALONG JALAN BELIAN, UNIMAS CAMPUS

Danial Rezan bin Fizal Rezan, Emelline Sikok, Haziqah Syazwani binti Ismail, Najibah binti Mohd Zaa'id, Nihel Syazana binti Mohammed Gani, Nor Osama Haikal bin Abdul Wahab, Nur Amani Syakirin binti Noor Razali, Regina Anak Kenedy, Ryan Isaiah Tan Chai How, Leviyashini G Subashandar

Asasi Eco-ambassador project, which is the rapid wildlife survey, that was conducted along Jalan Belian in UNIMAS Campus. This survey aims to focus on species of flora and fauna located along the targeted research area. Real life experience learning is a great method to promote better understanding in wildlife studies. Therefore, the rapid wildlife study was done by observing, taking photos, and identifying the species along the research area. The species that was documented based on sound recordings are Crimson sunbird and Purple-naped sunbird. Crimson sunbird or also known as '*Aethopyga siparaja*' can be found in forest or cultivated areas (**Table 2**). This bird is a resident breeder in tropical southern Asia from India through Nepal, Bangladesh and Myanmar to Indonesia and Brunei. The conservation status of this bird according to IUCN is the least concern. Next, Purple-naped sunbird is a species commonly found in Southeast Asia from Myanmar to Sumatra and Borneo. Their natural habitat is subtropical or tropical moist lowland forests. Its nape and rump are normally iridescent purple. It has olive-green upperparts, a streaked belly, and a dark, slightly curved bill. Apart from fauna, *Nephrolepis biserrata* and *Ficus aurea* are the types of flora that were discovered abundantly along Jalan Belian. *N. biserrata* is native to Florida, Mexico, the West Indies, Central America, South America, Africa, and Southeast Asia. It has a greyish brown stalk and broadleaf evergreen leaves. *Ficus aurea* has the strangler-like woods which hug its trunk.

Table 2. Classifications of species that found in Jalan Belian.

Taxonomy	Crimson Sunbird	Naped Purple Sunbird	Tropical Fern
Kingdom	Animalia	Animalia	Plantae
Phylum	Chordata	Chordata	Pteridophyta
Class	Aves	Aves	Polypodiopsida
Order	Passeriformes	Passeriformes	Polypodiales
Family	Nectariniidae	Nectariniidae	Nephrolepidaceae
Genus	<i>Aethopyga</i>	<i>Kurochkinogramma</i>	<i>Nephrolepis</i>
Species	<i>A. siparaja</i>	<i>K. hypogrammicum</i>	<i>N. biserrata</i>

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THE OBSERVATION OF PALM SPECIES IN UNIMAS

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Malaysia is a palm-rich country which has one of the highest diversity of palm species in the world. Palm trees are very important economically, due to the huge diversity of compounds that they produce in their fruits and seeds which are widely used in the local and international industries. The specific objectives of these observations of palm species in UNIMAS Campus are to help the students learn more about palm species and its nature. Photos of palm trees were documented and observed by using smartphone cameras. The specimens were identified by comparing the palm trees with existing palm tree samples from internet sources. Based on our observation, it is found that there were two types of palm tree. Their fountain shape made them to be categorized as *Arecaceae* family. The two samples are *Roystonea sp.* and *Bismarckia nobilis* (**Figure 9**). Through research, *Bismarckia nobilis* is found to live on well-drained soil and open grassland. The characteristics are short thick trunk topped by a broad rounded head, stiff, intensely steel-blue, fan shaped fronds. *Roysteana sp.* or commonly known, royal palms, are found in Malaysia. Royal palms are fond of water and thrive on supplemental irrigation. Royal palm trees are a source of rattan, thatch, fibres and fruits. The royal palm tree is widely planted for decorative purposes throughout its native region and in tropical climates. In conclusion, from the observation we found that there are two main palms that are *Bismarckia nobilis* and *Roystonea sp.* We could also understand that these palm species are suitable to grow and live in Malaysia, which grow abundantly based on their specific characteristics and the suitable conditions which grow abundantly because of these specific characteristic and suitable conditions.

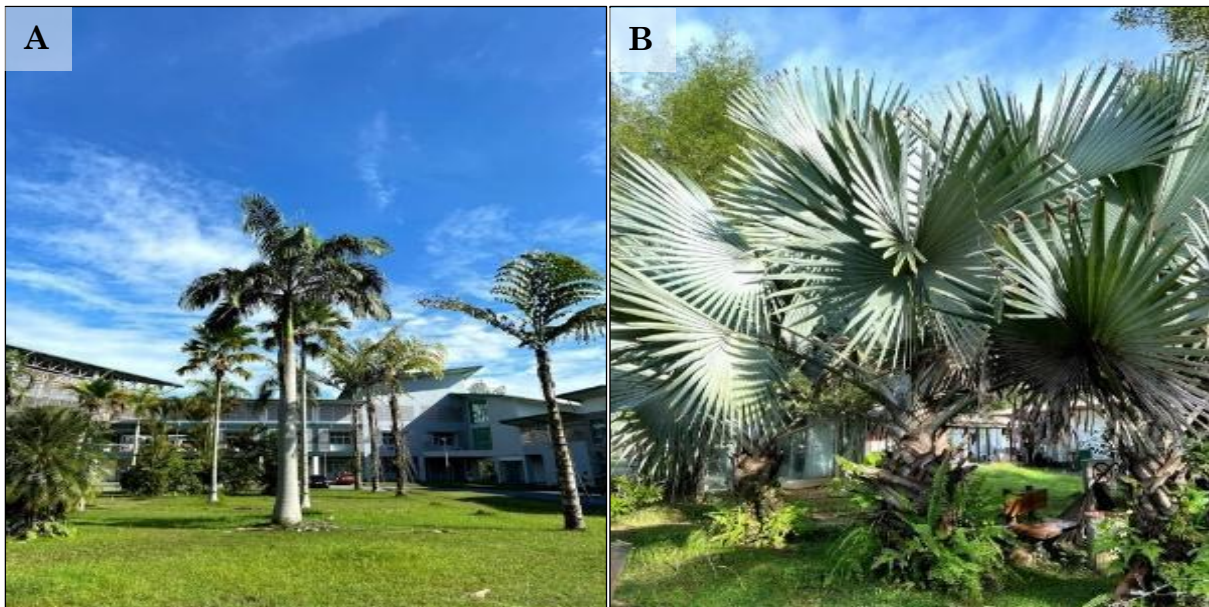


Figure 9. Palm in UNIMAS. **A.** *Roysteana sp.* recorded at the Faculty of Built Environment. **B.** *Bismarckia nobilis* recorded near East Campus Hall.

THE OBSERVATION OF POTENTIAL THREAT TO ECOSYSTEM IN UNIVERSITI MALAYSIA SARAWAK (UNIMAS), EAST CAMPUS

Aini 'Afiqah Gas @ Mohammad Hafiz, Amal Irham Rozaimi, Husna Hamdi, Khairun Nadiyah Irdina Khairull Sallekh, Mohammad Harundin Mohamad Yahya, Muhammad Aiman Haziq Muhammad Nadzrul Fadzli, Nur Amirah Faqihah Nur Adha, Nur Irdina Zaidi, Tricya Eunice Charles Martan

An observation of the potential threats to ecosystem in the UNIMAS, East campus is conducted. It took place at a lake neighbouring the Kenanga Food Court. The specific objectives of this study are to identify the possible water pollution factors, and the current and optimum condition for the studied area. Moreover, by conducting our research at the targeted site, we hope to determine ways to reduce the impact of the threat in the future for the environmental conservation of UNIMAS East campus. In this bulletin, a qualitative-based approach and suitable observation are proposed to develop the research solution: (1) field trip for observing the surroundings of the site and (2) conducting online research. The members participated in a field trip to further observe and collect data from the surroundings and the conditions of the lake by taking photographs using their own phone camera from different angles. The data collected are then further analysed by searching related online articles using the Internet. The observation shows the lake murky and greenish due to the drainage (**Figure 10**). We found that the nutrients from the waste are the cause of the growth of water lettuce. The large population of water lettuce has covered the surface of the lake and prevented sunlight from penetrating the lake. Aquatic plants are unable to absorb sunlight and produce oxygen causing the aquatic wildlife to die. Hence, the quality of water decreases. Water pollution may be natural or man-made, but regardless, they potentially release destructive agents or chemicals.



Figure 10. Potential threat of UNIMAS east lake. **A.** The drainage from the cafe to the lake. **B.** The uncontrolled growth of water lettuce.

THE OBSERVATION OF ANGIOSPERMS IN UNIMAS CAMPUS, SARAWAK

Ainaa Syazana binti Arifin, Amanda Balqis binti Harris Annuar, Areef Darnish bin Mohamad Azman, Irene Wong Lee Ting, Martha Nadia Anak Fremlin, Muhammad Farid bin Mohammad Jamil, Nur Azyan binti Aziz, Nur Nazurah binti Abdul Rased, Brian Bong Wei

Upon planning a field trip to the UNIMAS, students can enhance their knowledge in ecology, biodiversity, and the environment by exploring plants around the campus. The main objectives of Asasi Eco-Ambassador are to cultivate and instil the interest of students in angiosperms, learn how to identify angiosperm species, foster camaraderie among group members, and to improve relationships between students and educators. We have conducted our research on observing the angiosperms in UNIMAS campus by walking around the East Campus of UNIMAS in search of plants with flowers or fruits on them, which are known as angiosperms. Some species of angiosperms that we have found are *Spathodea campanulate* and *Melastoma malabathricum* (**Figure 11**). *Spathodea campanulate*, also known as the African Tulip Tree, is from the Bignoniaceae family. This species is an angiosperm with dicotyledon seeds. The hermaphroditic flower attracts birds for pollination. The oldest flowers are at the bottom of the peduncle. The flowering habit of this flower is polycarpic, meaning that it can reproduce more than once before dying. *Melastoma malabathricum*, also known as Singapore rhododendron, is from the Melastomatacea family. This angiosperm also has dicotyledon seeds. The flowers are 1 to 3 inches wide and its petal colours include dark purple-magenta, light pink-magenta and white. The lifespan of the flowers can only last a day. Plenty of angiosperms were seen around the PPPU campus. This abundance can be attributed to insect pollination, effective dispersal systems, diversity of growth forms, and other factors that allow flowering plants to dominate highly dynamic and species-rich vegetation.



Figure 11. Several species of angiosperms in UNIMAS. **A.** *Spathodea campanulate*. **B.** *Melastoma malabathricum*.

THE OBSERVATION OF PLANT-PLANT INTERACTIONS IN UNIMAS CAMPUS

Alfiwa Lulisma binti Ismail, Angelina Jalu Anak Peter, Cataldo Areno Anak Joki, Katerina Cheria Anak Jambai, Muhammad Muizzuddin bin Yusop, Natalisa Prisca Bujang, Nur Fazilah binti Azemi, Nur'Izzah binti Fauzan and Jonah Kuek Joo Hong. Biology

An observation was carried out in UNIMAS Campus to fulfil the learning objectives for Asasi Eco-Ambassador Project. The main goal of this fieldwork is to identify and explain the interaction between specific plants. Plant communities have positive, negative, and neutral interaction manners whereby they alter their availability of resources and their physical habitats around them directly or indirectly. Trees usually cast shade, moderate temperature, and humidity to alter rain penetration and texture of the soil. Neighbouring plants may buffer one another from strong winds and other stressful conditions. Some plants can also contribute simple compound such as ammonium to another plant after they die (Einhellig & Rasmussen, 2021). *Ficus watkinsiana* (Strangler fig) with parasitic interaction steals water, nutrients and sunlight through dense leaves and tendrils like roots that twist around the host plant (**Figure 12**). *Asplenium nidus* (Bird's nest fern) grows on a tree to obtain sunlight. The tree does not receive any benefits of harm. Hence, the interaction that occurs is commensalism interaction. While *Pleurotus ostreatus* (Oyster mushroom) which is saprophytic interaction, benefits the dying hardwood tree by decomposing the tree. Places that are suitable for parasitic or symbiotic plants are to be looked for when finding plant-plant interactions in UNIMAS Campus such as shady, moist, and humid places. For epiphytic plants, one should look under the canopy to find ferns or wild orchids. Ferns and other commensal species were mainly found through the observations around UNIMAS Campus. As for strangler fig trees, they mainly spread via seeds dropped by birds or other creatures that had eaten the seeds. Hence, places that are most abundant of these plants will have lots of wildlife and have an existing 'mother' strangler tree nearby.

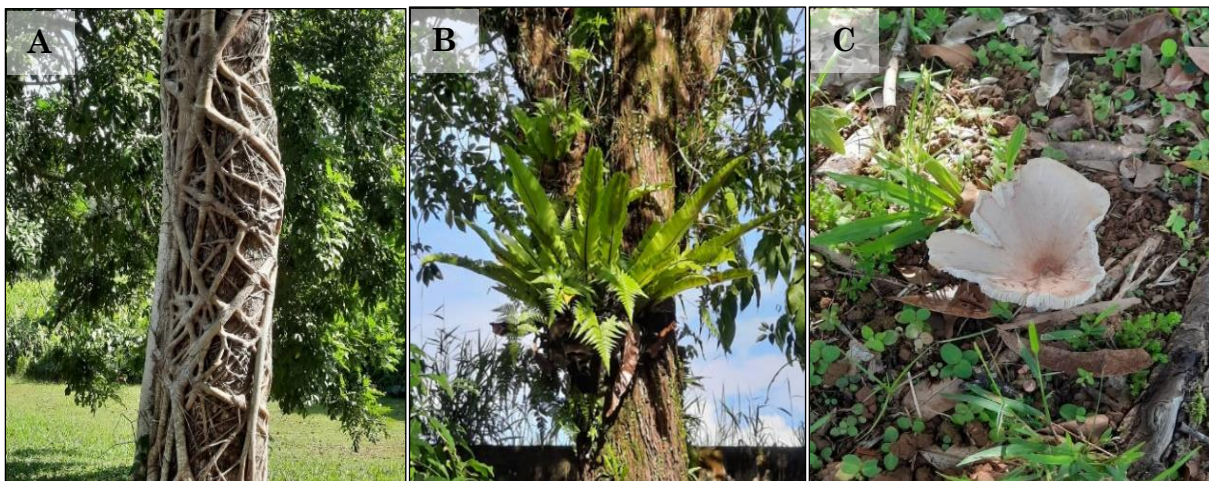


Figure 12. Example of plant-plant interaction in UNIMAS. A. Strangler fig species, *Ficus watkinsiana* B. Bird's nest fern species, *Asplenium nidus* C. Oyster mushroom species, *Pleurotus ostreatus*

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THE OBSERVATION OF PEAT SWAMP ECOSYSTEM IN UNIMAS CAMPUS

Aiezal Harith bin Azul Hanif, Amalin Aishah binti Razali, Arny Ashiqin binti Mohd Roslin, Geanao Gianni Merring Jozy, Margrate Anak Benjamin, Nur Aishahfatimah binti Yassin, Nur Izyan Ayuni binti Abdul Rahman, Nurul Farah Ain binti Abdul Rajak

This discovery was made to make people aware of how important peat swamp contributes to our ecosystem's balance. Peat swamp can be found in areas where there are saturated soils or frequent flooding happening, these specific conditions can prevent organic material from fully decomposing. Peat swamp can be visualised as a sponge that absorbs all the excess rainwater and the minerals from the saturated soils. As this organic material slowly accumulates, it retains even more water through capillary action. This role is important for managing the natural flood since peat swamp often comes from lowland forest. An observation was carried out at the designated site by looking for areas where the soil is moist. Then, a search for any flora and fauna that can be found in peat swamps was proceeded and several sample pictures were taken for proof (**Figure 13**). Additional information about the site were searched and compiled to document and learn about the peat swamp while observing it. Devices such as cameras, phones and laptops were used to take sample pictures and search additional information regarding peat swamps. The water is stained dark brown by the tannins that leach from the fallen leaves and peat, thus the term blackwater swamps. The peat is waterlogged throughout the dry season and pools between the trees remain. This study is carried out to expand students' knowledge on the characteristics of the ecosystem of the peat swamp, the roles the peat swamp plays and how important it is to UNIMAS's environment.

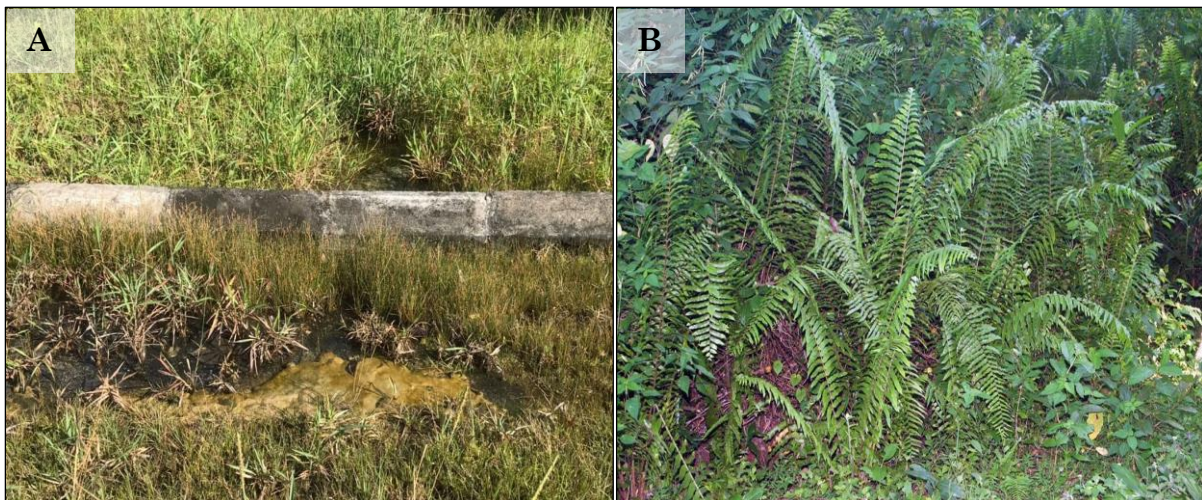


Figure 13. Peat swamp ecosystem in UNIMAS. **A.** One of the waterlogged during dry season **B.** *Nephrolepis biserrata miniata* is one of the main plant species in peat swamp as well as in the observed area.

THE OBSERVATION OF PTERIDOPHYTES (ECONOMIC VALUES) IN UNIMAS EAST CAMPUS

*Alif Farhan bin Mohd Fuad, Annabelle Robin Justine,
Cathrina Miyas anak Franklyn Lunyai, Jazmi Akmal bin Jamel, Natalia
Calista anak Francis, Nur Ardini binti Noh, Nur Rafidah bin Othman, Puteri Nurul
Aisyah binti Abdullah*

Pteridophytes, such as ferns are spore bearing plants which do not produce both flowers and seeds (de Winter & Amoroso, 2003). Roos (1996) has recorded 1165 species of ferns in Malaysia tropical rain forest and 757 species are found in Sarawak alone. The most common species of pteridophytes in Sarawak are *Cyathea contaminans*, *Dipteris conjugata* and *Platynerium coronarium* (Forest Department Sarawak). The objective of this study was to observe and document the economic values of pteridophytes found in UNIMAS East Campus. A short observation was conducted along Jalan Belian of East Campus of UNIMAS which is about 1 km long on 31st December 2020 at 8 to 9.30 a.m. Pteridophytes found along the road and trees were observed and a few were selected to be documented by using camera. Two types of ferns were documented namely Bird's nest fern (*Asplenium nidus*) and Midin (*Stenochlaena palustris*) (Figure 14). *Asplenium nidus* is known for its medicinal benefits and occasional use as ornamental plants. The infusion of the fronds of *A. nidus* is believed to be able to ease labour pain, while when pounded in water it can be used as a lotion to treat fever (Figure A). This epiphytic fern is typically found attached on trees but it can also grow on the ground as a landscape design (Khoo, 2011). Its young fronds can also be eaten when they are still coiled as a prophylactic (Khoo, 2011). Lastly, *S. palustris* is a popular local delicacy in Sarawak which is usually cooked with shrimp paste. It is a wild plant hence it is free of agricultural chemicals (Chai *et al.*, 2016). In conclusion, pteridophytes contributes greatly in terms of economic values, and this includes the ferns in UNIMAS East Campus. Similar studies in the future are encouraged to promote sustainable exploitation of pteridophytes.

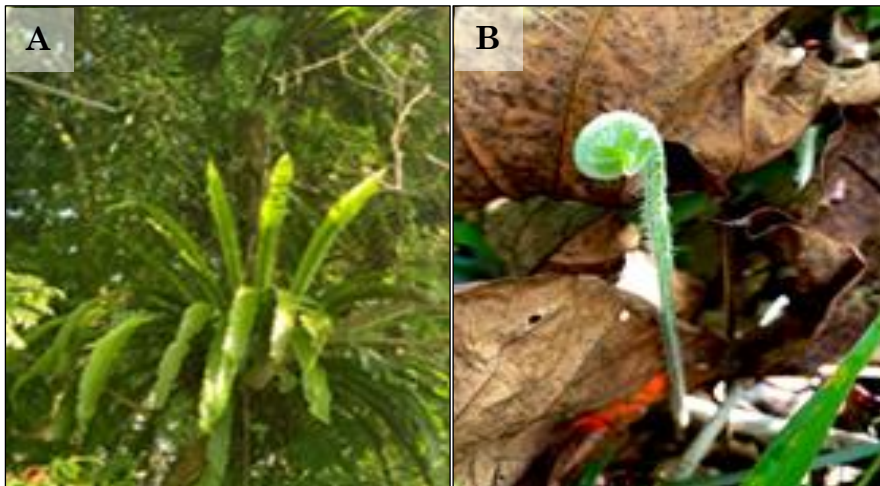


Figure 14. Example fern species in UNIMAS. **A.** *Asplenium nidus*. **B.** *Stenochlaena palustris*

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THE OBSERVATION OF *NEPENTHES* IN UNIMAS CAMPUS

Ainatun Suhaila binti Azmi, Allechia Nisi Anak Simry, Belinda Manuel, Fakhrur Hijjaz Danial bin Abdul Taib, Gloria Vanetta Anak Dandy, Nik Nur Maiza Arisha Shamira binti Sakri, Nur Hafizah binti Auda, Nur Mahirah binti Rohaizan, Raja Muhammad Naufal bin Hj Raja Taufik Azad, Shawn Giles Steve Primus, Estee Fatma binti Fariddy

In pursuance of appreciation and acknowledgement to ecology, biodiversity, and environment, an expedition was carried out to establish physical inspection and observation of *Nepenthes*, a genus of carnivorous plant. The principal objectives were to implement best practices including question-asking, communication, observation and to enhance team cooperation for scientific documentation. Therefore, the task to observe and identify the species of *Nepenthes* had been conducted. The expedition was done throughout Jalan Kapur in UNIMAS West Campus. Students have collected pictures of *Nepenthes mirabilis* and conduct research for further species confirmation using various resources. It was recorded that *N. mirabilis* is a widespread species in Borneo especially from the western and northern parts of the island (**Figure 15**). *N. mirabilis* is distinguished by its slender pitcher, the mouth is slightly oblique, peristome is nearly cylindrical to slightly flattened, and slightly coiled tendrils (Robinson, 2020). Hence, the information on its morphological features obtained is useful and sufficient to classify and determine the species. *N. mirabilis* attracts a variety of insects flying around which in turn attracts other carnivorous animals such as mantis, spiders, ant-lion flies, lizards, and tree frogs (Hua and li, 2005). It is also responsible as a model for ecosystem change due to the water-filled pool within acts as a tiny ecosystem that works almost similarly to full-scale water body. Fortunately, the IUCN conservation status of *N. mirabilis* is listed as Least Concern (Clarke, 2014). The observation has helped us to be more familiar with *N. mirabilis* which plays major role in ecosystem processes like nutrient cycling and a study model for complex aquatic environment.



Figure 15. Pitcher plant species observed in UNIMAS. **A.** *Nepenthes mirabilis*. **B.** *Nepenthes mirabilis*

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THE OBSERVATION OF PLANT-ANIMAL INTERACTIONS IN UNIMAS CAMPUS

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Plant-animal interactions are ubiquitous and significant. The interactions between plants and animals can be called coevolution as both are interdependently evolved together. The main learning objective of this study is to remark the interlinkage between plants and animals in the studied environment. The research was done through observation around the UNIMAS campus. Identifications of plant-animal interaction were accomplished by looking at animals perched on plants. Several photographs were taken for documentation purpose by using a camera or smartphone. Besides, more information about the plant-animal interaction has been browsed through the infinite resources on the Internet. Plant interacts with honeybees via mutual interaction (**Figure 16**). Dioecious plants fully depend on pollinators to reproduce. Most honeybees depend on botanical assets for their requirements such as nectar and dust. The plant species that live in a mutualistic association with a colony of ants are Myrmecophytes. These plants have distinct adaptations such as domatia and extrafloral nectaries that give food and shelter to ants. To conclude, both interactions share the same type of ecological interaction which is mutualism. Plant-animal interactions have evolved in some cases to make them interdependent for nutrition, respiration, reproduction, or other aspects of survival through the process of natural selection.



Figure 16. Example of plant-animal interaction in UNIMAS. **A.** Bee feeds on nectar and pollen of the flower. **B.** A colony of ants on plants.

RAPID WILDLIFE SURVEY IN EAST CAMPUS, UNIMAS

Alyssa Rosetam, Anis Sofia Suhaini, Deana Sophiya Mohd Azmir, Emilian Elmo Jimmy, Kelly Deirdre Kennedy, Mohammad Daniel Adib, Nik Nur Elyana Izzah Nik Mohamed Hazmi, Nur Alyaa Mohd Sabirin, Nurhaziqah Ismail, Nur Sabrina binti Mohd Bakhtiar, and Mohamad Fhaizal Mohamad Bukhori

UNIMAS are blessed with natural heritage and surrounded by lush flora and fauna. Therefore, learning, and documenting biodiversity, ecology, and environment are relevant and meaningful. Objectives of the activity are to reinforce experiential and contextual learning, to expose students to nature and new environment, and to offer students a unique cultural learning experience. The activity was conducted around East Campus of UNIMAS to do rapid wildlife survey around the campus. Pictures of the wildlife were capture followed by analysing the data by referring to the established reference. The activity has recorded *Dillenia suffruticosa*, and *Nepenthes mirabilis*. *Dillenia suffruticosa* is a species with yellow-coloured flower that will develop a pink fruit with star shaped capsuled (**Figure 17**). *Nepenthes mirabilis* is a carnivorous plant that feeds on small animals typically insects and other arthropods. In this study, the relative relationship between fauna population density and area has been addressed explicitly by three ecological theories which are the equilibrium theory of island geography, the phenomenon of density compensation, and the resource concentration hypothesis. Therefore, rapid wildlife survey can be done to understand basic needs of plant and animal species protection and their habitats as the human population influences on their resources. This observation is important as wildlife provides balance and stability to nature's processes as it is part of the ecosystem. Furthermore, this activity also helps to further understand how wildlife adapt to their habitats to survive and its life cycle.



Figure 17. Example of organism recorded during a survey. **A.** *Dillenia suffruticosa* with pink fruit
B. *Nepenthes mirabilis*

THE OBSERVATION OF FUNGI IN UNIMAS CAMPUS

Nur Athirah Mustapher, Marie Jane Luwen, Nurul Fariyah Ismail, Ammaey Abdul Assyim Chong, Asmeralda Soh Ai Leen, Muhammad Haikal Aiman Jaya, Muhammad Aimanul Ahsan Musa and Saidatun Nabihah Mohamad Nazri

In order to accommodate, enhance and attain the course learning objectives of ecology, biodiversity and environment within the class, the best key to enrich the study of fungi is by conducting actual fieldwork observations at UNIMAS campus. The precise objectives of this fieldwork are for sustainable learning, adopting excellent practices in scientific documentation, and implementing a holistic learning approach within the course. Observations of fungi species were specifically conducted in areas with abundant trees, warm temperatures and high humidity which are the optimum fungi habitat. Careful observations were done and multiple photographs were taken using cameras for further identification. Students were given the related case study and turns out with a few credits. Throughout the study, different family with different species of fungus were found and classified (**Figure 18**). Until now, fungus is well known by its potential of breaking down organic resources and releasing oxygen, phosphorus, nitrogen and carbon. In Figure 18 A shows *Mycena manipularis*, this fungus decomposes the deadwood of hardwoods from the Great Plains eastward. While in Figure 18B shows *Phallus indusiatus*, the veil of this fungus allows non-flying insects to crawl up and disperse the spore filled gleba. In Figure 18C, *Heterobasidion annosum* is a major pathogenic fungus of both young seedlings and mature trees, where it produces characteristic root and butt rot. As a result, there are varieties species of fungi that can be found in UNIMAS campus due to the area has high humidity and damped preferably for the growth of many species of fungi. On top of that, it is a noble act to acknowledge the existence of fungi because it plays a major role in an ecosystem.



Figure 18. Fungi recorded in UNIMAS. **A.** *Mycena manipularis* is a species of saprobic fungi. **B.** *Phallus indusiatus*, commonly called the bamboo mushrooms, crinoline stinkhorn or veiled lady. **C.** *Heterobasidion annosum* is a basidiomycete fungus in the family Bondarzewiaceae.

THE OBSERVATION OF GYMNOSPERMS IN UNIMAS CAMPUS

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Delevoryas (2016) stated that gymnosperm is a species of vascular plant which reproduces through an exposed seed, a condition where their ovules are not enclosed in an ovary instead it is covered by leaf-like structures known as megasporophylls. Observation is carried out to analyse the characteristics of conifers, one of the examples from the gymnospermous plant. The data were collected in front of the CPUS Whitehouse. From the result obtained, we identified a species of conifer called *Juniperus chinensis* (Figure 19). It is commonly known as Spartan Junipers due to its unique needle and scally shape of leaves, with a length of 5-10 mm long for juvenile needle leaves. While for its adult scale leaves, the length is 1.5-3 mm long. It can grow 1-20 m (3.3-65 ft) tall, with its narrow width of 3-5 ft at maturity. It can be planted during the fall by setting the shrub in a hole that has been dug wider and prefers well-drain soil with a slightly acidic condition. Usually, they are better adapted to the dryer and cooler habitats but most of the time they form their solid stands in colder mountain areas. Therefore, coniferous plants mostly can be found in the boreal region of the northern hemisphere since they are more abundant in cold, snowy areas that experience short summers. The reproductive structure of the conifer includes gametophyte and cone for both male and female. Male cone produces microspores which are then developing into pollen grains (n). Pollen grains (n) fuse with the megaspores in the female gametophyte to form mature sporophyte (2n). The sporophyte is the dominant generation in the gymnosperm species because the gametophytes generation completely dependent on the sporophyte to obtain food and nutrients needed for growth.

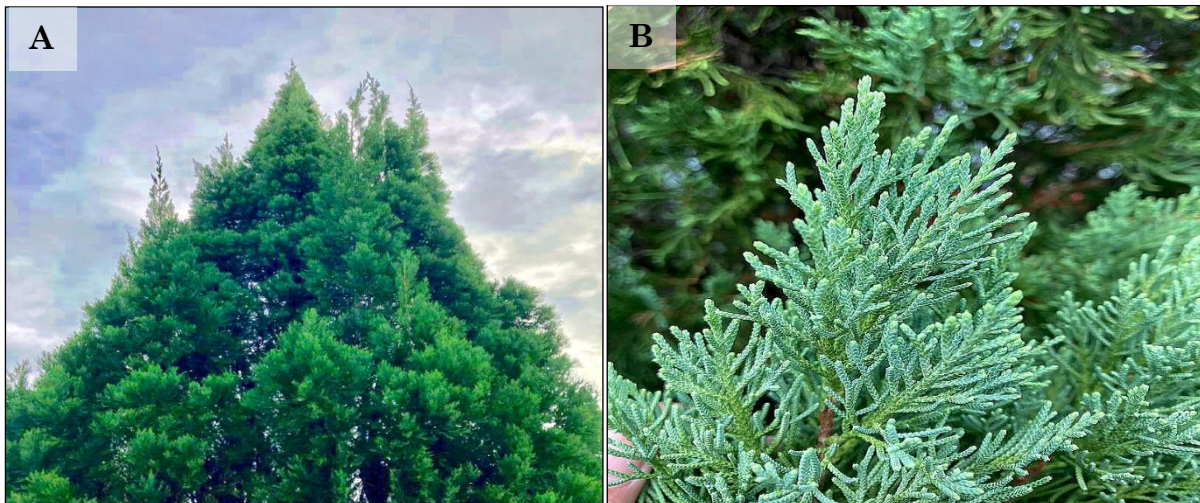


Figure 19. Example of gymnosperms in UNIMAS. **A.** Tree of *Juniperus chinensis*. **B.** Leaves of *Juniperus chinensis*.

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THE OBSERVATION OF NEPENTHES IN UNIMAS CAMPUS

Farah Damia binti Mohd Zulkifli, Azmira Syazwani binti Azmir, Ilya Ivarisya binti Iskandar, Noor Sue Wastadiah binti Agas, Nur Masita binti Mohd Esa, Pascalles Gani, Scholastica Antonia binti Steven, Syarifah Nur Aini binti Wan Sekeran, Steven Chan Chia Ming

Nepenthes is a genus of carnivorous plants, also known as tropical pitcher plants or monkey cups in the monotypic family *Nepenthaceae*. It is located predominantly in Southeast Asia. This genus grows wildly and can be found in moist open areas in tropical rainforest especially in swampy areas. *Nepenthes* consists of a shallow-rooted system and a prostrate or climbing stem. The pitcher contains a leaf-like lid to protect the inner pitcher from being contaminated by rain and dust, as well as reduces the evaporation of the pitcher fluid. They capture and digest prey including insects and other small animals as a main nitrogen source to deal with the nutrient-poor soil. The main objective of this activity is to learn about the *Nepenthes* species. *Nepenthes gracilis* and *N. ampullaria* are two different species that were observed in this activity. The pitcher plants can be spotted at the side of the road. Field observation was done to differentiate these two species of *Nepenthes* through its colour, shape, size and environment. Photos were taken for further review. In this activity, the characteristics of both *N. gracilis* and *N. ampullaria* were successfully identified and studied (**Figure 20**). Based on the observations, some pitchers grow near the ground and some grow higher on trees. There are terrestrial and epiphytic species which are lowland and highland species. Terrestrial or lower pitchers are usually the large, younger traps, which typically sit on the ground. Upper or aerial pitchers usually form as the plant reaches maturity and the plant grows taller. They capture different prey where the aerial pitchers catch more winged prey while terrestrial pitchers attract more wingless prey. The pitcher plant is such a unique plant. Other than that, *Nepenthes* grow in acidic soil with low organic matter content. To be more specific with the type of soil that the species need, *N. ampullaria* grow in sandy clay and loam soil while *N. gracilis* grow in sandy loam, loam and sandy clay soil. In conclusion, two species of *Nepenthes* which are *N. gracilis* and *N. ampullaria* were observed. These species can live in soil with poor conditions. They also can grow either as aerial or terrestrial pitchers so that they can trap insects as a source of nutrients.



Figure 20. *Nepenthes* species found in UNIMAS. **A.** *Nepenthes ampullaria*. **B.** *Nepenthes gracilis*.

THE OBSERVATION OF MACROINVERTEBRATES IN UNIMAS LAKE EAST CAMPUS

Aiman Danial Jasni, Bethricia Anak Woa, Hajar Hasnan, Izyann Alish Muhammad Azirul Airidi, Nur Airin Farisha Mohamed Badusha, Nur Zulaiqha Abdol Wahab, Siti Nursyafiqah Abdullah, Uzwaliza Izzany Abu Bakar, Isaiah Ho Chi Ann

Invertebrates are animals without vertebral column. This group of animals plays significance roles in keeping the ecosystem balanced. This short observation aimed to briefly document macroinvertebrates found in UNIMAS Lake East Campus (man-made lake). Hence, short observation and random catch- and-release sampling by using aquarium fish nets were conducted in one of the lakes on the 7th of January 2021. Data and photos were documented. Seven different macroinvertebrates were recorded (**Table 3** and **Figure 21**). The type of invertebrate that lives in lakes articulates the level of water pollutants there such as moth (Abdel Gawad, 2019). Since moth is very sensitive to any changes in the lake ecosystem, it is particularly useful as an indicator species. If there is high abundance of moth, this indicates that the environment is in good condition. Black snail was the highest macroinvertebrate sampled. They are important in maintaining the water quality as they eat algae and other organic debris at the bottom of the lake. The interaction between macroinvertebrates helps in keeping the lake ecosystem clean (Michaluk, 2019). Conserving these interactions is extremely important since they influence the biological condition of environment at the lake ecosystem. Overall, from this outdoor learning, observers have been exposed to macroinvertebrates interactions in keeping the nutrient cycling in the ecosystem.

Table 3: Macroinvertebrates recorded in Lake East Campus.

No.	Phylum	Common name	Total individual
1	Mollusca	Garden snail	2
2	Mollusca	Black snail	40
3	Arthropoda	Water strider	10
4	Arthropoda	Dragonfly	10
5	Arthropoda	Grasshopper	3
6	Arthropoda	Moth	2
7	Arthropoda	Prawns	6



Figure 21. Some of the macroinvertebrates recorded at one of the UNIMAS Lake East Campus.

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THE OBSERVATION OF HORTICULTURE PLANTS IN UNIMAS CAMPUS

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Upon organizing a field trip in UNIMAS campus, learners can broaden their horizons with horticultural knowledge. The objectives of Asasi Eco-Ambassador are to inculcate and promote interest and participation in horticulture, identify horticultural plants species, foster comradeship among learners and promote cordial relationships between learners and educators. Learners were assigned to explore, identify and capture aesthetic photographs of horticulture plants in UNIMAS campus and categorize them into flowering and non-flowering plants according to their unique characteristics (**Figure 22**). *Plectranthus scutellarioides* was identified as a horticultural non-flowering plant with brightly coloured and patterned foliage. It serves as a traditional medicine in Malaysia to treat asthma and allergies. *Zamioculcas zamiifolia* was observed as an ornamental non-flowering plant with shiny dark green leaves that act as air purifiers by filtering toxins such as xylene and benzene in the air. Next, an ornamental flowering plant with elegant red blossoms, *Zinnia elegans* was determined to be an antibacterial agent and folk medicine for the treatment of malaria and stomachache. *Ixora coccinea* was recognized for its large cluster of tiny flowers and functions to cure tuberculosis, diarrhoea and unhealable wounds (Lundman, 2018). Hence, horticulture plants are renowned for their contributions and usage to most organisms, especially all mankind. In concise, learners should utilize knowledge and information attained from the trip for holistic research and educational purposes, wise management and promotion of horticultural plants in future.



Figure 22. Horticultural plant species observed in UNIMAS campus including **A.** *Plectranthus scutellarioides*, **B.** *Zamioculcas zamiifolia*, **C.** *Zinnia elegans* and **D.** *Ixora coccinea*

Reference

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RAPID WILDLIFE SURVEY ALONG JALAN BELIAN, UNIMAS CAMPUS

Nur Dini binti Rosdi, Liana Natasya binti Mohd Khalid, Aesha Amna Akmal binti Sajali, Nurul Husna binti Zulkifli Ong, Irdina Imaani binti Md Razani, Adriell Joimi, Ariff Hakimi bin Alias, Effinie anak Handi Wander and Vivien Jimbai

A scientific analysis was conducted for students to understand the biodiversity value and types of rapid wildlife that exists in Sarawak along Jalan Belian in UNIMAS. During this survey, students collected data by taking photograph of species of wildlife that can be found around the surveyed area. With the information that is obtained during the survey, students were able to observe biodiversity of each species. There are three different species of wildlife that have been identified to be highlighted in this article which are Peacock Pansy caterpillar, Simpoh ayer and Little spiderhunter (**Figure 23**). Peacock Pansy caterpillar or in its scientific name, *Junonia almana* is an insect which is black and have white dots on its body. This species can be found in Cambodia and South Asia. This Peacock Pansy caterpillar will eventually become a Pansy butterfly with beautiful wings. The caterpillar feeds on different plants as a food source. Meanwhile, Simpoh ayer also known as *Dillenia suffruticosa* is a one-of-a-kind plant that usually pink in color. This species lives in tropical Southeast Asia, more specifically on muddy terrain. Parts of this plant can be used in the treatment of inflammations, itchy skin, stomach pain, and to aid woman's recovery after giving birth, whereby the leaves and roots of this plant are used. Lastly, the Little spiderhunter, *Arachnothera longirostra*, a species of bird that is mainly found in South and Southeast Asia. Males and females are very close in plumage, unlike most sunbirds. They are most found living around flowering plants, where they get nectar as their food source. The Little spiderhunter was under the least concern (LC) category in the IUCN Red List of Threatened Species, however, recently, in 2016 this species was placed in the vulnerable (VU) category. Overall, this biological trip has made students aware of the importance of flora and fauna as they provide enormous benefits to humanity in the form of medicinal and food offerings. This biological research trip exposed the students in data collection, species identification and at the same time, appreciating the wildlife along Jalan Belian hence, recognize the importance of biodiversity.



Figure 23. Example organism found along Jalan Belian. A. *Junonia almana*. B. *Dillenia suffruticosa*. C. *Arachnothera longirostra*

THE OBSERVATION OF PALM SPECIES IN UNIMAS CAMPUS

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Palm trees are from the family Aceraceae which is a family of perennial flowering plants in the monocot order Arecales. They are distinguished by their large, compound evergreen leaves known as fronds arranged upon the top of an unbranched stem and are commonly found in tropical and subtropical climates. The objectives for this fieldwork are to identify and differentiate the types and species of palm trees found in UNIMAS campus area which are the *Bismarckia nobilis* and *Veitchia merrillii* (**Figure 24**). The observation of palm species has been done to achieve the objectives of this scientific documentation. There are many types of palms in UNIMAS campus area. Those species including *B. nobilis*, *Cycas revoluta*, *Livistona chinensis*, *Trachycarpus fortunei*, *Rhapis excelsa*, *Roystonea* sp., *Chrysalidocarpus lutescens*, *Ptychosperma macarthuri*, *Chamaerops humilis* and *V. merrillii*. Palm plants have been so advantageous to the human and economy as most parts of the palm plants in particular the leaves, fruits, branches can be very beneficial for centuries. To conclude, palm species like the *B. nobilis* and *V. merrillii* are prevalent around the UNIMAS campus is because of their habitable habit which is bound to grow in tropical areas.

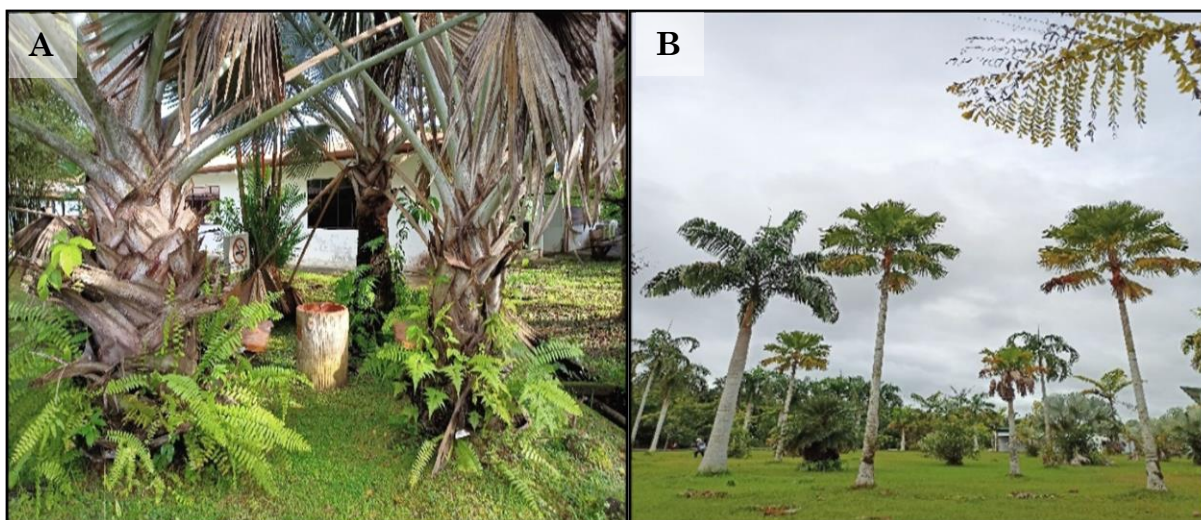


Figure 24. Example of palm trees at UNIMAS. **A.** *Bismarckia nobilis*. **B.** *Veitchia merrillii*

POTENTIAL THREAT TO THE ECOSYSTEM IN THE WHITE HOUSE LAKE AT THE EAST CAMPUS OF UNIMAS

Aimi Shafiqah Bujang, Angelica Sim Lee Fong, Ferdinand Morientes Rantai, Holyvia Subat, Jeremy Roeshen Gilbert, Marchella Mendung Bak, Nabilah Bibi, Nur Syafina Mohd Kamal and Siti Nabilah Rosli

There are common and different environmental impacts as, for example, all plants and animals are climate change susceptible, water pollution may disrupt the ecological balance of an aquatic environment. Noxious and destructive substances may be released into the environment which is due to pollution and this can harm the health of living organisms and damage the quality of non-living things. The main objectives are to identify significant ecosystem threats to develop information, skills and materials that may be useful in recognizing and understanding the possible threat to ecosystem. By the method of observation, it was determined that the potential threat to the ecosystem of the white house lake could come from the drain located next to the lake (**Figure 25**). This drain may cause contaminated fluids such as oil, dirty water, and/or food and drink containers to flow into the lake. Poor drainage system is one of the threats for lake ecosystem in UNIMAS as it carries multiple wastes that is poisonous and harmful to the aquatic organisms. These poisonous wastes can kill organisms such as small fishes, and plants. In animal food chain, organisms such as plants and small fishes are important as they serve as food for other organisms. Without these plants and small organisms, the other consumer will suffer from the side effect and even disrupt the whole animal food chain which in return will destroy the whole ecosystem in the lake. To sum up, by researching the potential threats to the local ecosystem of White House lake, we recognize the drainage system and irresponsible act of littering as the most prominent potential threats. The information will be used further to develop effective and practical solutions to help maintain a healthy ecosystem using the skills and materials we have obtained from this research. We wish to record our deep sense of gratitude and profound thanks to the research supervisor, Mr. Aminuddin, for his keen interest, inspiring guidance, and constant encouragement with the work during all stages, to bring this thesis into fruition.



Figure 25. Potential threat of pollution at East Campus. **A.** Contaminated drain that located around the White House lake. **B.** Student taking a picture of the poor drainage system that contains small fish in the lake at the White House lake.

THE OBSERVATION OF ANGIOSPERMS IN UNIMAS CAMPUS

Awliya Syauqina binti Ismail, Aisyah Nadiah binti Ibrahim Putra, Nazatul Athirah binti Mohamad Iswadi, Nureen Fatin Nabila binti Mohd Zahir, Najwa Hannani binti Mohd Yusoff, Irdina Ahba binti Norman, Syaza Nureirina binti Mohd Razif, Mclouie Ak Michael, Mior Mohamed Zuhayr bin Ghazali

Angiosperms are the biggest and advance group in the Kingdom Plantae. In order to identify and differentiate the characteristics of several species of flowering plants in UNIMAS Campus, this study/observation have been conducted. Identification and naming the species is significant to understand the different types of organisms that have different unique characteristics. This study was done through an expedition around UNIMAS East Campus. As a result, there are seven types of flowering plants that have been identified. Out of these seven species, two species have been chosen to be highlighted in this report which were Chinene rose (*Hibiscus rosa-sinensis*) and Malabar melastome (*Melastoma malabathricum*) (**Figure 26**). The pictures of both flowers have been captured and all the related information have been gathered from prominent books and webpage internet sources. The present information is useful for purposes of education as well as understanding the species of angiosperms. The Eco-Ambassador was conducted to introduce the student with a compressive learning experience on biodiversity-related issues.



Figure 26. Example of angiosperms at UNIMAS Campus. A. *Hibiscus rosa-sinensis* B. *Melastoma malabathricum*

THE OBSERVATION OF PLANT-PLANT INTERACTION IN UNIMAS CAMPUS

Raveena Neela Mayang Anak Ronny, Balqis binti Abdul Wahid, Alya Danisha binti Nazim, Muhammad Amir Harith bin AB Ghaffar, Mohammad Rasydan bin Sulaiman, Izzan Hazirah binti Harun, Noor Akmal Irdina binti Ahmad Kamil, Nur Alis Arwina binti Mahmudin, Nurul Asyiqin binti Mohd Azizan.

An observation was carried out in UNIMAS Campus to fulfil the learning objectives about plant-plant interaction for Asasi Eco-Ambassador Project. The relationship which occurs between same or different species of the plants within an ecological community is classified as a plant-plant interaction. It can be identified by their characteristic and behavior towards each other. Competition between plants usually occur due to its growth-limiting resources such as nutrients, water, and sunlight for their survival. Facilitation also can be occurred by increasing the access to limiting resources for interacting species. Scientists have revealed that plants connected via the air and the soil which act as medium that create thread-like networks. The observation was carried out by field trip to observe the interaction between *Salix* sp., *Bryophyta*, *Platyserium*, and *Pyrossia confluence* at the marching plateau in front of CPUS office and Belian Street along UNIMAS East Campus lake in the CPUS. The main objectives of this study are to identify the relationship between plant-plant interactions and to certify the effects of the interactions towards plant growth and productivity. Based on the study, it can be identified that there are few interactions among some species on the *Salix* sp. For example, *Pyrrrosia confluens*, *Bryophyta* sp. and *Platyserium* sp. (**Figure 27**). The relationship between these three plants is commensalism. These species are living on the big tree to get sunlight for survival. *Pyrrrosia confluens*, *Bryophyta* sp. and *Platyserium* sp. live on the *Salix* sp. as the host and most of them usually commensalism. They tend to grow along the branches as to be exposed more to sunlight without effecting the host. (Gianalberto, 2017).



Figure 27. Example of plant-plant interaction in UNIMAS campus. **A.** Willow tree, *Salix* sp. **B.** Elkhorn fern, *Platyserium* sp. **C.** Horseshoe felt fern, *Pyrrrosia confluens* sp. and Mosses, *Bryophyta* sp.

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OBSERVATIONS OF UNIVERSITI MALAYSIA SARAWAK EAST CAMPUS PEAT SWAMP FOREST

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A Biology field trip known as Asasi Eco-Ambassador was conducted to allow the students to observe the characteristics and biodiversity of UNIMAS East Campus peat swamp forest. Peat swamp forest is a waterlogged forest growing on a layer of dead and partially decomposed plant materials. As time goes, the organic materials will accumulate steadily and form a dome-shaped muddy bog. The bog will retain the water levels after a heavy rainfall, thus forming a waterlogged soil. Furthermore, the presence of humus gives the water retained on the soil a dark brown colour and an acidic property with pH 4 or less (Posa, *et al.*, 2011). Moreover, peat swamp forests act as a carbon sink which absorbs more carbon from the atmosphere than it releases and helps to slow global warming (UNDP, 2006). Besides that, the trees in the peat swamp forest are tall and have woody trunks (**Figure 28**). The possible species of the trees is *Shorea albida* or its common name, Alan bunga. The tall trees function as the canopies which block the sunlight and provide shades to the fauna in it. In addition, they also minimize the direct contact of heavy rain onto the soil thus, preventing soil erosion and flash flood from occurring in the campus. Not only this, the peat swamp forest is surrounded with ferns, mosses and grass because the wet and muddy soil around it is very suitable and favourable for their growth. In conclusion, the peat swamp forest of UNIMAS East Campus is unique and holds a good diversity due to its various characteristics and the presence of different types of flora. Thus, conservation and preservation of the peat swamp forests are very pivotal to maintain the balance of the ecosystem.



Figure 28. Peat swamp area at UNIMAS East Campus. **A.** Waterlogged area. **B.** Types of flora in Peat swamp forest.

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THE OBSERVATION OF PTERIDOPHYTES (REPRODUCTIVE STRUCTURE) IN UNIMAS EAST CAMPUS

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It was estimated that about 10500-11300 of the fern species have been described and 1165 species were recorded in the tropical rain forest of Malaysia (Yusuf, 2010). In Sarawak, Kubah NP has recorded a total of 22 families, 38 genera and 63 species of ferns and fern-allies (Mohammad, 2016). One of the most abundant fern species in Sarawak is the *Stenochlaena palustris* (Nicholas, 2013). The objective of this study was to observe and document the reproductive structures of pteridophytes found in East UNIMAS Campus. A brief one-hour observation on pteridophytes in front of UNIMAS White House Office was conducted on 7th January 2021. Pteridophytes found were selected and documented with a camera. Most common species found was *Nephrolepis exaltata*. The leaflets of mature ferns are turned to expose their lower surfaces, which have many dry, bumpy brown spots that is known as sorus (Zhang & Zhang 2015) (**Figure 29**). Each sorus is guarded by an umbrella-like flap called indusium. Since sexual reproduction is the main method of fern reproduction, most matured ferns have sporangia under their leaflets. Sporangia are the sexual reproductive mechanism of ferns to produce many haploid spores by meiosis. These haploid spores will be released by the tearing of annulus in each sporangium (Helmenstine, 2020). Ferns reproduce asexually by their modified stems which are called rhizomes that spread below the soil surface and form roots on their undersides.



Figure 29. A. Sori on the underside of frond. B. Rhizomes, the only stem of fern.

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THE MAGNIFICENT HORNBILLS OF SARAWAK

Airul Shamirzuan Mohammad Safri, Akma Rasyidah Azin, Alis Natasya Zulaman, Anis Syazwani Ahmad Bolkiah, Easter Lavenda Vincent, Luqman Nul'hakim Jeffry, Norsalinda Elmylia Khairudin, Nur Amiratul Syafiqah Jamal, Nur Rabiatul Adawiyah Ismail, and Saiyidah Nafisah Akmar Azry Akmar

Known as the Land of Hornbills, Sarawak is home to over eight out of 54 species of hornbills in the world. Black hornbill, Helmeted hornbill and Rhinoceros hornbill (**Figure 30**) are some of the hornbills that can be found in Sarawak. The Borneo state gained the title 'Land of Hornbills' due to the cultural symbol the hornbill represents for the Dayak people. They believe that hornbills signify the spirit of God and thus they are integrated into elements of their culture. The size, colour and the massive bill of a Hornbill are what makes this species of Aves so unique and distinct from the others. The purpose of this study is to acquire more knowledge about the magnificent hornbills of Sarawak. The data collected from websites and articles should be reliable, secure and written by trustworthy sources to avoid inaccurate information from being presented. Hornbills are extremely important for the dispersal of seeds and plant reproduction due to their ability to commute over long distances. However, according to the data that Malaysian Nature Society (MNS) has collected between 2004 and 2018, more hornbills' species are endangered and might go extinct due to poaching and rapid development of the land in which a lot of trees are being sacrificed to fulfil humanity's needs. Hornbills need large trees to nest in as they tend to travel far during the migration season. Zoologist has reported that due to years of poaching, the helmeted hornbills are now critically endangered (Borneo Post Online, 2020). A helmeted hornbill casque is valuable in the black market and around 2878 casques were seized globally between the year 2010-2017, stated by the non-governmental organization. Due to this, the conservation of hornbills is needed to maintain the ecological balance of our ecosystem and prevent transmission of zoonotic diseases. Unplanned, rapid development needs to be protested and be more mindful of our consumption as forests are often being sacrificed for human excesses. Therefore, human played a vital role to prevent this spectacular species from being extinct by educating more about these issues.



Figure 30. The Rhinoceros hornbill is one of the hornbill species found in Sarawak (Borneo Post Online, 2020)

Reference

<https://www.theborneopost.com/2020/07/16/zoologist-many-sarawakians-still-cannot-identify-their-own-state-bird-rhinoceros-hornbill-video/>

RAFFLESIA OF SARAWAK

Alyssa Jazira binti Azmie, Amanda anak Meta, Andria Buri anak Ibrahim, Athilah Syazwani binti Shafie, Constatine Kalang anak Leping Hariffin, Gwendoline Nilie anak Mitaha, Nur Alia Athirah binti Mohd Hanapiah, Nur Damia binti Azman, Nurain Hazirah binti Othman, and Siti Marlina binti Jasni

Rafflesia is a genus of parasitic flowering plants in the Rafflesiaceae family. The species have large flowers, buds growing from the ground or directly from the lower stems of their host plants. They are in Southeast Asia, Malaysian Peninsula, Borneo, Sumatra, Thailand, and the Philippines. ‘Corpse flower’ is the nickname of this unique flower as its smell could be described as the scent of decomposing meat. The fact behind this is to attract flies who assist in the pollination of this exceptional flower. There are ten species of *Rafflesia* found around Malaysia, and three of which are found in Sarawak *R. arnoldi*, *R. pricei* and *R. tuan- mudae*. *Rafflesia tuan-mudae* is found in Gunung Gading NP (**Figure 31**). *Rafflesia* is a parasitic plant whereby it feeds off the nutrients of hosts. The only known host of *Rafflesia* is from the genus *Tetrastigma* (*Vitaceae*). *Rafflesia* is known for their release of strong ‘corpse-like odour. However, the species in Sarawak releases a faint odour; only when the flower takes on a deeper colour. It usually grows in rich alluvial or limestone-derived soil and is restricted to the primary and secondary forest of altitudes below approximately 2000m. In 1997, *Rafflesia* was added to the International Union for Conservation of Nature (IUCN) red list of threatened species. This also includes some *Rafflesia* species in Sarawak such as *R. pricei* and *R. tuan- mudae*. There are several reasons that cause *Rafflesia* to be classified as an endangered plant. One of them is illegal logging. It has been a serious problem in Sarawak for a long time. This will wipe out the forest and *Rafflesia* which its habitat is on the forest floor. Furthermore, *Rafflesia* is known to be a type of herbal medicine. Some illegal collectors will collect and sell it for a high profit in the market despite *Rafflesia* being an endangered plant in Sarawak. Other than human interventions, *Rafflesia* is also endangered because of its specialised habitat. In Sarawak, we will find *Rafflesia* in an area which is named Gunung Gading NP. Gunung Gading NP is found near the tiny town of Lundu in Southwest Sarawak. Gunung Gading NP is one of the most prominent places in Asia to look at the spectacular blooms of the *Rafflesia*. This is also where the young *Rafflesia* buds can be seen scattered around the forest floor.



Figure 31. *Rafflesia tuan-mudae* in Gunung Gading NP

HEART TO HEART WITH ORANGUTAN IN SARAWAK

Angela Syeranie Anggon, Arina Min Sedin, Azian Nadiyah Faisal, Azzrull Aminuddin, Holynnas Subat, Jonathan Joseph, Nur Asyiqin Ab Aziz, Nur Fitri Sashzaratul Shima Hermanus, Nurul Adriana Hadirah Mohd Haslin, and Syarifah Nuriffah Aisyah Syed Aznan

Bornean orangutan (*Pongo pygmaeus*) is an orangutan species endemic to the island of Borneo including Sarawak. Together with the Sumatran orangutan and the Tapanuli orangutan, they belong to the only genus of great apes native to Asia. Like the other great apes, orangutans are highly intelligent, exhibiting the use of resources and distinctive cultural behaviours in the wild. Orangutans share about 97% of their DNA with humans. Bornean orangutan is a critically endangered species, with deforestation, palm oil and hunting as a significant threat to its continued life. An online study was conducted via various established academical journals regarding orangutan populations and conservation strategies in Sarawak. Orangutans are at risk of forest destruction, deterioration of habitat and illegal hunting. Therefore, Heart to Heart with Orangutan is an effort that encourages the public to become aware of them. The program gives participants a closer look behind the scenes of orangutan conservation work. The program starts with a briefing on the conservation program in a “Get to know” session before proceeding with a guided tour of the wildlife centre (**Figure 32**). The participants will be assigned a simple task of food preparation such as insects, peanuts, and young leaves for orangutans and many more. In conclusion, the information obtained is useful for the conservation of orangutan rehabilitation awareness, to increase the understanding of public regarding the challenges faced to maintain orangutan rehabilitation and related work at the centers and to get a deeper knowledge about orangutan in general.



Figure 32. Activities conducted during the program. **A.** Participants at a closer look behind the scenes orangutan conservation work **B.** Participants assigned a simple task of food preparation

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ETHNOBOTANICAL REVIEW OF WILD EDIBLE FUNGI IN SARAWAK

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In Malaysia, more than 50 local species of macrofungi are edible and at least more than 20 local species are known to have medicinal value. This article will review how the wild edible fungi in Sarawak can be useful to a human being. All the information in this article were made through online reading i.e., journals, webs and books. According to Malaysia Biodiversity Information System (MyBIS), wild edible fungi that can be found in Sarawak are *Lentinus squarrosulus* and *Cookeina tricholoma* (**Figure 33**). These macrofungi have a unique flavour and contain a high amount of protein, fibre, minerals, vitamins and reduced lipid. The results and information obtained about the fungi species are useful for research and educational purposes, developing the food and culinary industry, and discovering medicinal purposes for the healthcare industry. *L. squarrosulus* is a type of wild edible mushroom that are beneficial to the local community in Sarawak for its taste and meaty texture as well as its supported medicinal benefits. *C. tricholoma* is part of the cup fungi family. In Mexico, it is used in cooking, while, in Cameroon, it is used in medicine to relieve earaches.



Figure 33. Example of edible fungi in Sarawak. **A.** *Lentinus squarrosulus*. **B.** *Cookeina tricholoma*

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CHECKLIST OF GYMNOSPERMS IN SARAWAK

Adelaine Miya anak Kilee, Bibianna Imelda binti Collins, Dayang Nurhanis Halisya binti Awang Ekshaan, Ezyan Tasneem binti Ezani, Jessiera Angelique anak Ginii, Mohd Irfan Danial bin Zainal, Muhammad Aiman Hakim bin Ahmad Faiz, Nuraliesya Zulaikha binti Zulkifli, Nur Lynna Rashiedah binti Norzelan, and Siti Nur Atiqah binti Mohd Kamal

Gymnosperms are plants that produce cones and seeds and usually referred to as having naked seeds which they do not produce any flowers or fruits. The seeds can develop on the surface of reproductive structures of the plants rather than being contained in a specialized ovary. This documentation is carried out fully online to identify two families of gymnosperms in Sarawak, Araucariaceae and Gnetaceae. Araucariaceae has spirally arranged and narrow broad leaves which create the roof of the forest. It also has a yellowish white, straight-grained wood. The resinous, very thick bark is ridged with the bases of old leaves. In some species, it is rough and peels off in papery scales. The seed cones are large, disintegrating when mature and each ovuliferous scale bears a single ovule. One of the species, *Agathis borneensis* can be found in Bario, Sarawak. Meanwhile, Gnetaceae has the conspicuous, netlike veining of broad leaves (10-20 cm) of *Gnetum* species which superficially resembles angiosperms (**Figure 34**). In comparison to other extant gymnosperms, *Gnetum* species are unique extant gymnosperms with high photosynthetic and transpiration capacities. The xylem hydraulic capacity is greater compared to other gymnosperms. Deeply rooted with a strong tap root system and commonly branching in whorls, *Gnetum gnemon* can be found at secondary jungle in Sarawak.

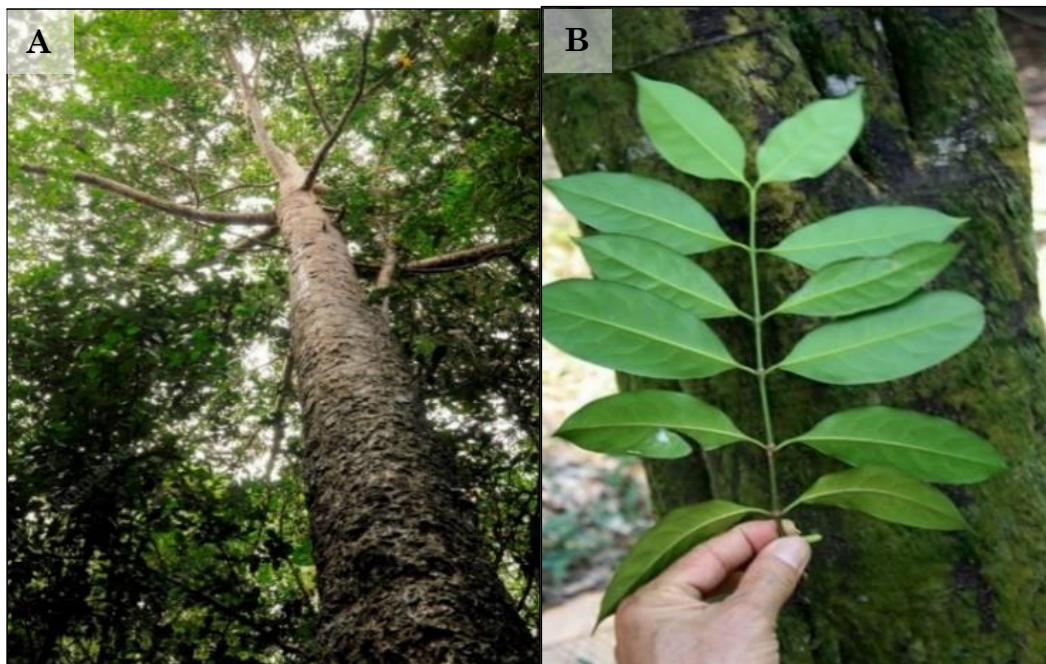


Figure 34. Example of gymnosperms in Sarawak. **A.** Tree of *Agathis borneensis*. **B.** Leaves of *Gnetum gnemon*.

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A POCKETGUIDE OF NEPENTHES IN SARAWAK

Dalili binti Makhtar, Elsa Junih Frankie, Farhah Fatimah Az-Zahrah binti Muhammad Hassan Anas, Fatin Qistina binti Hamzah, Magdelina Bellarina, Muhammad Amir Shah bin Badli Shah, Nur Syazrin Habsah binti Ismail, Nurul Ain Syafiqah binti Mohd Kamal, and Sylviana Genisia Anak Gat

East Malaysia is currently home to 29 species of *Nepenthes*, more diverse compared to West Malaysia that has six species of *Nepenthes* (Clarke, 2001). The main objective of this article is to discuss the habitat of *Nepenthes* and to identify several species of *Nepenthes* that can be found in Sarawak. *Nepenthes*, a carnivorous pitcher plant that is the only genus in the Nepenthaceae family, is also known as a tropical pitcher plant or a monkey cup. *Nepenthes* are vines that can grow in habitats such as cloudy montane forests, mangroves, peat swamp forests and heath forests. They can grow on various infertile substrates like epiphytic substrates, ultramafic soils, white sands, cliffs, or peat. The substrates are characterised by the scarcity of nutrients, nitrogen or their non-availability in a form easily assimilated. These rare carnivorous species are plants that, through adapted pitcher-shaped leaves that act as traps to catch insects and other prey. The morphology of stems, leaves, the shape of the upper and lower pitchers, and the adaptation in the ecosystem of the *Nepenthes* have been discovered by a lot of experts. The flowers have no petals, are inconspicuous and contain wind-dispersed minute seeds. The prey falls from the mouth of the pitcher attracted by nectar secreted from the underside of the trap's lid into the bottom that contains liquid and is unable to escape due to the downward-pointing hairs and slippery sides of the pitcher were later be digested by enzymes gradually. Twenty-one species of *Nepenthes* have been recorded in Sarawak. The most spectacular species is *N. lowii* where the pitcher has a narrow constriction half-way up. *Nepenthes ampullaria*, *N. rafflesiana* and *N. gracilis* are found by roadsides while *N. northiana* is endemic to limestone (**Figure 35**). Other species are confined to swamp forest and montane forest.

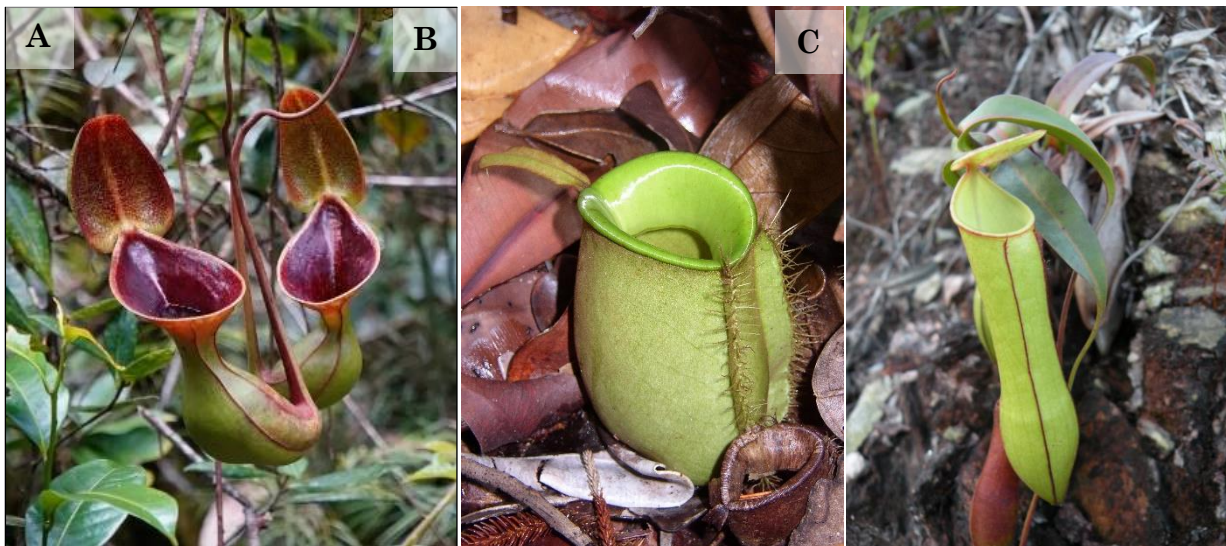


Figure 35. *Nepenthes* of Sarawak. **A.** *Nepenthes lowii*. **B.** *Nepenthes ampullaria*. **C.** *Nepenthes gracilis*.

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DID YOU KNOW RAJAH BROOKE'S BIRDWING OF SARAWAK?

Fannye Anye Janim Liu, Gwen Anak Severin, El'Veinnice Chin, Nadhatul Suhana binti Azli, Nurfirlyana binti Rajiman, Nur Umairah binti Bustami, Nurus Syuhada binti Ja'afar, Wan Nadzirah binti Wan Nadhri, Muhammad Haziq bin Mohamad, Muhammad Mirzan Aiman and bin Mohamad Marzuki

Rajah Brooke's Birdwing, *Trogonoptera brookiana*, is a species of rare butterfly. The butterfly was named in honour of James Brooke, the first Rajah of Sarawak and is the national butterfly of Malaysia (Condamine *et al.*, 2016). This brief review aimed to briefly document the wings colouration of the Rajah Brooke's birdwing. Group meetings were carried out to discuss and compile related data gathered via online research and previous publications. Rajah Brooke's birdwing is identified through its long wings and their bird-like flights. Male birdwings have black wings and contain greenish shade on the hindwings while female birdwings have browner with prominent white flashes at the tips of the forewings and the base of the hindwings (Wilts *et al.*, 2016). large electric-green patch on the males' forewings and hindwings may look distasteful and can be a disguise to fool their predators (Parry, 2020) (**Figure 36**). These colorations also help to attract female Rajah Brooke's birdwing to mate. In contrast, the female Rajah Brooke's birdwing is recognized with its brown wings. The unique long wings and bird-like flights are the adaptations of the Rajah Brooke's birdwing, that have helped them to survive from predators. Rajah Brooke's birdwing also listed in the IUCN Green Status of Species, which means that this species is performing its ecological functions in its habitat (Akçakaya *et al.*, 2018). From the research that had been done, we can conclude that the characteristic of Rajah Brooke's birdwing is long wings and bird-like flights. These characteristics help them to survive from predators. Hence, it is crucial that conservation initiatives from related agencies to be carried out to preserve Rajah Brooke's birdwing from extinction.



Figure 36. Rajah Brooke's birdwing. **A.** Black wings with Electric-green patch on male forewings and hindwings. **B.** Brown coloured wings on female with prominent white flashes at the tips of the forewings and at the base of the hindwings.

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DIVERSITY OF WILD GINGER IN SARAWAK

Agnes Sherry anak Jack, Farhana binti Zulkifli, Filzah binti Othman, Heidi Nur Farah binti MD Yuzaidy, Nur Adila binti Zamri, Nurul Akma Azwa Az Zahra binti Ramli, Ratna Raffyna binti Fatlly, Aaron Kendall Lu Soon Hua, Neil Erickson anak Nelyson

The purpose of documenting and researching about the diversity of wild ginger in Sarawak via online is to learn about their distribution, uses and variety. In general, ginger is a flowering plant with rhizome that is widely used as a spice as well as traditional medicine. Wild gingers especially give a lot of benefits to the human body, specifically in terms of health. Aside from treating an upset stomach, wild gingers have also been proven useful in treating open wounds and inflammation. Gingers in general have high antibacterial properties and by conducting research regarding the diversity of wild ginger in Sarawak, we hope to help others understand more about gingers. The method used was through research. Research done has found the various types of wild ginger found in Sarawak. That includes several genera of wild gingers like *Alpinia*, *Amomum*, *Boesenbergia*, *Burbidgea*, *Camptandra*, *Elettariopsis*, *Etilingera*, *Geocharis*, *Haplochorema*, *Plagiostachys*, *Scaphochlamys*, and *Tamijia*. The largest genus of wild gingers was *Amomum* with all 41 species recorded, followed by *Etilingera*, with 40 known species. These are mostly found in lowland and streams, with low light intensity, and high humidity but some of the native species can tolerate the full exposure of sun. In conclusion, Wild ginger in Sarawak has a unique and excellent stockpile of nutrients that have varieties contributions in medicine and being used as fragrance and spices. The benefits are meant to be shared to all living organisms to achieve the greatest unity in our diversity. Hence, this incredibly shows that Sarawak is one of the great examples of the richest and most diverse area for the gingers globally especially within the Asian tropics.

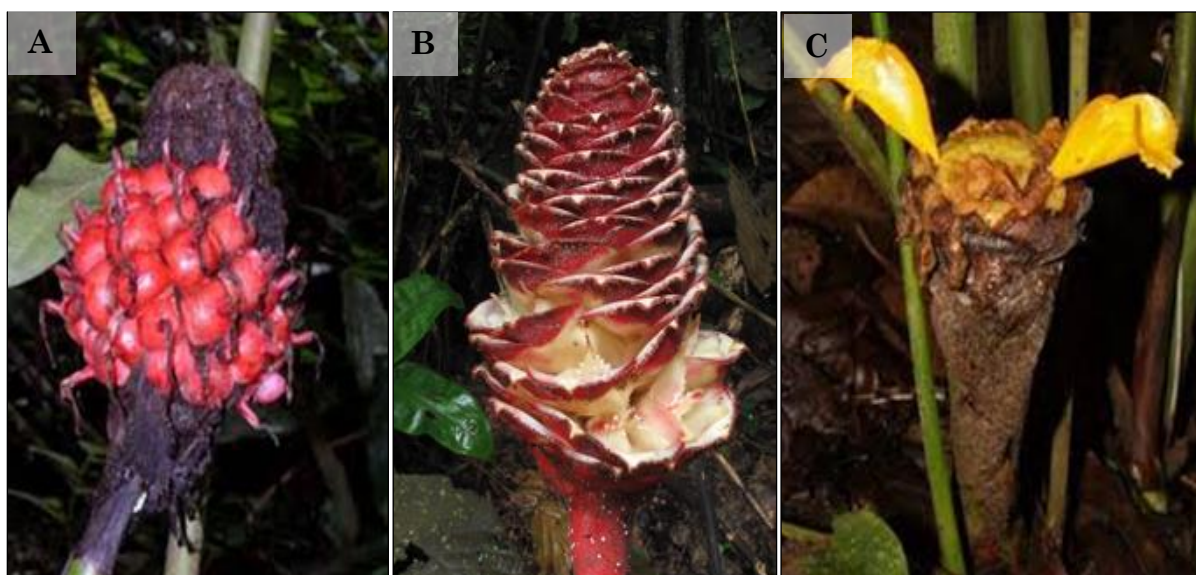


Figure 37. Cudgel-shaped inflorescence of ginger. **A.** *Etilingera elatior* (Photographed by Peter Boyce). **B.** *Zingiber kelabitianum* (Photographed by Alan Clessleron). **C.** *Amomum dimorphum* (Photographed by Peter Boyce).

Spotting Rare Irrawaddy Dolphins in Sarawak

Ain Fahimatun Sakinah binti Adanan, Freddanya Isabell Bonius, Hana Blausanova Anak Gimbun, Intan Syafiza Halida binti Mustafa, Nur Alya Aimuni binti Mohd Azilan, Nuryun Qatina Zahra binti Sabrini, Samuel Nullai Anak Sawa, Sheana Kasih Benedict, and Victor Lee Sien

Sarawak is one of the few regions to host the Irrawaddy dolphin (*Orcaella brevirostris*), a species of coastal cetaceans. It is classified as an endangered species by the IUCN. This study was carried out to investigate the sightings of *O. brevirostris* within Sarawak coastal waters and to investigate the significance of the *O. brevirostris*. Data collection for this study was conducted through online research of journals, scientific articles, and photographic data to achieve the objectives of this study. According to Minton et al. (2013), common sightings of *O. brevirostris* are found around the Kuching Bay area, which includes the Kuching Wetlands NP, Talang-Satang Island Marine Sanctuary, and Bako NP. According to Bali et al. (2017), dolphins were also found to roam along the Rajang River (**Figure 38**). The ecological relationship between the *O. brevirostris* and humans is mutualism. The dolphins would often drive fish into fishermen's fishnets, and they would often get fish as a reward. Gillnets are the common reason for the deaths of *O. brevirostris*. The *O. brevirostris* play a huge role in maintaining the population of fishes and squids, hence creating a dynamic ecosystem for the food chain. The extinction of these dolphins may lead to overpopulation of fish and squids, causing an imbalance in the ecosystem. In conclusion, the information obtained from this study is beneficial for educational purposes, and in preserving the endangered *O. brevirostris*.

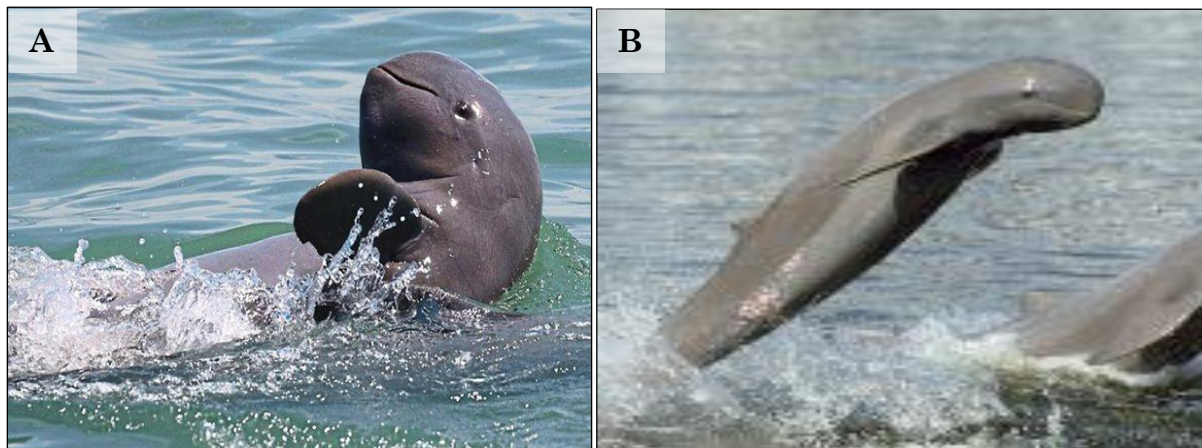


Figure 38. Irrawaddy dolphin in Sarawak. **A.** An individual was spotted surfacing its head at the Rajang River of Sarawak. (Tripcarte.Asia, 2020). **B.** Two individuals spotted breaching at the Santubong River mouth of Sarawak. (Tripcarte.Asia, 2020).

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WALKING WITH PALMS SPECIES IN SARAWAK

Aazhaiqal Aziqq bin Razemi, Aisyah Zakirah binti Zaidell, Hanis Damia Nadhirah binti Lokman, Iffah Hakimah binti Zuhairi, Izzfeesya Irdina binti Idris, Nur Athirah binti Farhan Nur Aiman, Ravella Agmond Lim, Siti Nur Zulaiha binti Nasri, Zulfaqar Anwar Iskandar bin Daud

Palm trees are synonymous with tropical beaches, warm sunny climates, and beautifully landscaped gardens. Palms are recognized by their fan-shaped or feather-like fronds (leaves) and fiber-covered trunks or stems. In order to accommodate, enhance and accomplish the course learning objectives of ecology, biodiversity, and environment, research was conducted. The objective was to observe the diversity of palm species in Sarawak. Therefore, each student in the group is required to find information about palm species in Sarawak through Internet. Palms are classified under a family called Arecaceae or Palmae. Sarawak provides a wide variety of habitats for palms. From 31 genera with a total of 261 species of palms in Sarawak have been identified through research. There are several ways to identify species of palm trees. Students can identify the different species of palm trees by looking at the distinctive shape of the palm fronds or leaves such as *Johannesteijsmannia altifrons* and *Iguanura palmuncula* (**Figure 39**). *J. altifrons* is one of the most stunning palm trees in the world. They have large diamond shape leaves shooting into the understory, unlike others. For *I. palmuncula* it has a small understory palm on which the leaf segments can be highly variable in width. There is another way to differentiate the type of palm tree. Students also can observe the trunk shape of the palm tree. Each palm tree species has a different trunk shape. Many species of palms have been planted along the roadside and ornamental trees other than produced edible fruit and shoots, palm trees also have commercial value by producing furniture, mats, and basketry. There is also recent evidence that, at the cellular level, palms may indeed be the oldest living trees because their cells are not replaced with new cells, as is the case with other trees. To sum up, there are various types of palm that can be observed in Sarawak and each of them has its own uniqueness.



Figure 39. Example of palm from Sarawak. **A.** *Johannesteijsmannia altifrons* **B.** *Iguanura palmuncula*

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TEN PROMINENT FRUITS IN SARAWAK

Alyaa Amany Shim Noramine, Arden Howard Dickson, Eric Leon Gom, Ilya Firzah Mohd Azahar, Jachinta Valantine Melody Lagan, May Joseph, Nur Faezah Sabli, Siti Ainul Basirah Mohamad Azmi, Tiffanny Thomas, and Mohamad Fhaizal Mohamad Bukhori

In Sarawak, most of the prominent fruits are considered a delicacy as they are indigenous to the Borneo Island. The online review was done to make a short study related to the topic as to identify the ten prominent fruits in Sarawak. Among them are locally known as Pulasan, Salak, Tampoi, Terap, Mata Kucing, Asam Embang, Belimbing Merah, Dabai, Engkala, and Keranji (**Table 4**).

Table 4. Relative facts about ten prominent fruits in Sarawak.

No.	Fruit	Facts
1.	Pulasan <i>Nephelium mutabile blume</i>	<ul style="list-style-type: none"> ▪ Part of the soapberry family Sapindaceae ▪ Has less sweet taste than Rambutan
2.	Salak <i>Salacca zalacca</i>	<ul style="list-style-type: none"> ▪ Species of palm tree family ▪ Short-stemmed palm species
3.	Tampoi <i>Baccaurea macrocarpa</i>	<ul style="list-style-type: none"> ▪ Has tangerine taste ▪ Found in clusters on the Tampoi tree
4.	Terap <i>Artocarpus odoratissimus</i>	<ul style="list-style-type: none"> ▪ Has relation with with cempedak and nangka ▪ Has soft spines covering its rind
5.	Mata Kucing <i>Euphoria malaiense</i>	<ul style="list-style-type: none"> ▪ Has black seed which looks like cat's eye
6.	Asam Embang <i>Mangifera panjang kostermans</i>	<ul style="list-style-type: none"> ▪ Bears fruit twice a year ▪ Very sweet and tangy
7.	Belimbing Merah <i>Baccaurea angulata</i>	<ul style="list-style-type: none"> ▪ Belong to same family tree as the Tampoi and rambai
8.	Dabai <i>Canarium odontophyllum</i>	<ul style="list-style-type: none"> ▪ Also known as black olive and mainly found in Kapit and Sibul
9.	Engkala <i>Litsea garciae</i>	<ul style="list-style-type: none"> ▪ Will turn from green to pink when ripe
10.	Keranji <i>Dialium indum</i>	<ul style="list-style-type: none"> ▪ Has a similar look to the Dabai ▪ Part of the family Fabaceae

In general, the short review has enabled us to realize that there are many benefits and uses that the ten prominent fruits in Sarawak have, a part of remains as a local and cultural heritage. Although they are also grown in orchards for local needs, many of these fruits are also found growing wild in the forest, therefore, enable us to acknowledge them as a food biodiversity.

THE TRANSITION OF TRADITIONAL BUNGAI TERUNG

Anis Alicessa binti Affendy, Hannah Tan Yit Yung, Kimberley Erica Anak Frankie, Mimi Azira binti Ahmad Zaidil, Mohammad Amirul Amizan bin Baidi, Mufeed Ilham bin Adnan, Nur Ahlami binti Mohd Kamaruzaman, Nur Maisarah binti Mohamad Ramzi, Yasmin Khadijah binti Hamdan Kamil.

Bungai terung is a symbol synonymous with the Iban ethnic group in Borneo. Historically, the native people of Borneo derive their tattoo designs from nature such as endemic plants and animals which resemble their spiritual prowess. Hence, the objective of this study was to unveil about the transition of traditional Bungai terung in Sarawak. To achieve the objective, study on the morphological characteristic of eggplant flower and its relation to the traditional tattoo (Bungai terung tattoo) were done. Bungai terung is a term in Iban ethnic, at Sarawak that refers to the flower of eggplant tree (*Solanum melongena*) (**Figure 40**). It is a warm-season vegetable that belongs to the nightshade family. Its flowers are purple and do not grow in clusters (solitary inflorescence). The observations were made on the flower phenotype such as the length of style and stamen and the color of petals. The stamen and style of the flowers was collected by cutting the flower open using a scalpel. The length of both style and stamen were recorded using a ruler. Based on the observation, most of the flowers have a longer style compared to stamen and the petals are white to purple in color. The information collected from this observation is important as eggplant flowers are hermaphrodite which is a self-pollinated plant. The style which is higher than stamen is one of the aspects that facilitate the pollination of eggplant flowers, thus influence the yielding. The Bungai terung tattoo is worn by Iban men who reached puberty to indicate their entry into adulthood. In Kalimantan, the Bungai terung tattoo is not worn if the Iban male has not gone on a journey (bejalai) (Mohammad P., 2020). In Sarawak, the applicable of tattoo is based on its own sequence in time. Starting from the 'isi ginti' (fishhook) tattoo during pre-puberty, followed by 'Bungai terung' which signify entry into adulthood. The meaning of eggplant flower in this case is to remind them of their roots while the coil at the center which resembles the underbelly of tadpoles represent the readiness to walk into the world as a grown man. The study is useful to enrich the information that is already available on Bungai terung and allow the development of understanding towards Iban tattoo culture in Sarawak.

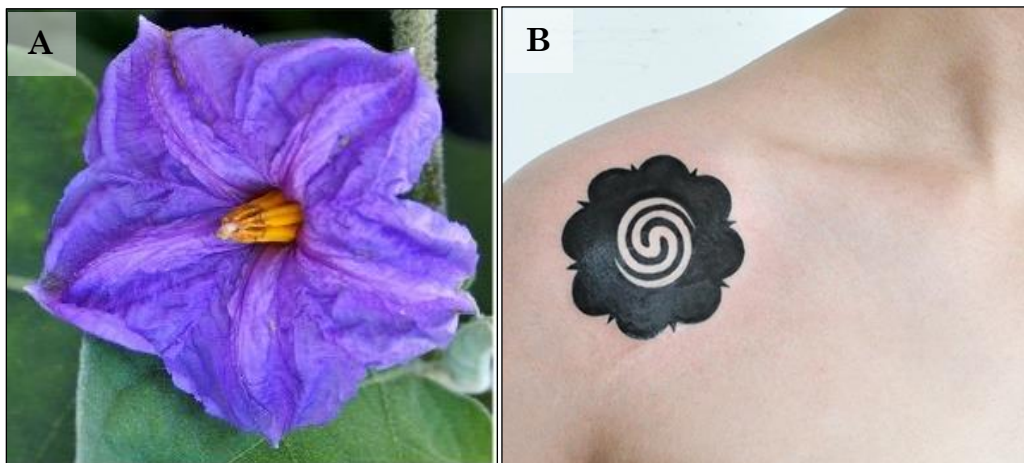


Figure 40. A. Bunga Terung (eggplant flower). B. Bungai terung (tattoo).

PLANT-PLANT INTERACTION IN SARAWAK FROM COMPETITION TO FACILITATION

Ainaa Syaidatul Akma binti Hadi, Ashley Mas Anak Gimang, Mariam Sofiah binti Mohd Rahimi, Muhammad Zulhilmi bin Zainal Abidin, Muhammad Aqil bin Nor Nazrul, Muna binti Kamal, Nur Ameera Qistina binti Hashim, Nur Syuhada binti Ahmad Suhami and Kueh Sin Joul.

Plant-plant interactions are defined as positive, negative or neutral relationships between plants. There are two mechanisms of interactions, which are competition between plants and facilitation of plants (Einhellig & Rasmussen, 2021). Plant-plant competitions generally refer to the negative consequences on plant growth or robustness caused by the presence of neighbours. It usually causes the reduction of the availability of resources to its neighbour plants (Keddy & Cahill, 2017). Course learning objectives, fostering critical thinking and analytical skills were complemented in the data collection for this study, which were from the internet and trusted websites. Plant-plant competitions can be found in Sarawak, for example the parasitic plant species, *Rafflesia arnoldii* which can be seen in Gunung Gading NP, Lundu. It can be defined as the positive relationship between at least two plants, where the presence of one plant is advantageous to the growth, reproduction, and survival of another plant in its vicinity (All Answers Ltd, 2021). The best fit for this plant-plant facilitation is epiphyte that grows on other trees to get sufficient nutrients and sunlight without giving any harm to the host. It is not parasitic on the supporting plants, and it does not bind to the soil or any other apparent source of nutrients. The *Benstonea* species such as *Benstonea epiphytica* are the epiphytic plants that can be seen in Gunung Mulu NP, Sarawak (**Figure 41**).



Figure 41. Example of plant-plant interaction. **A.** *Benstonea epiphytica*. **B.** Bloomed *Rafflesia arnoldii* flower species, *Rafflesia arnoldii*.

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WHAT IS PEAT SWAMP ECOSYSTEM IN SARAWAK, AND WHY SHOULD WE CARE?

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Peat swamp forests are formed when saturated soils or frequent flooding prevent organic material from decomposing completely. Peat swamps, which act as a giant sponge that holds in moisture, eventually form a dome of wet organic material that can rise above the surrounding flood levels (Bell, 2014). With the progression of time, this resulted in the formation of a thick layer of acidic peat. The peat swamp forests are important for human populations, such as traditional cultures that rely on them directly for food, water, fuel, and timber sources, traditional medicine and materials for domestic goods production (**Figure 42**). The ecosystems are well-represented among Borneo's major forest formations, but they are uncommon outside of Southeast Asia. They are endowed with biological diversity, distinguished by organic soils that have developed recently, within the last 5000 years. Their distinct ecological characteristics, as well as logistical challenges in accessing and utilising peat swamps, have not deterred exploitation. Some of the tallest and most commercially desirable timber species, such as ramin (*Gonystylus bancanus*), have been harvested on a regular basis in Sarawak's peat swamp forests. Due to its primary location in coastal lowlands near human activity, drained and reclaimed peat swamp land is desirable for development of highways, housing, and industrial and plantation estates (Abang & Gumal, 1995). Hence, peat swamp ecosystems do have reasons to be cared for.

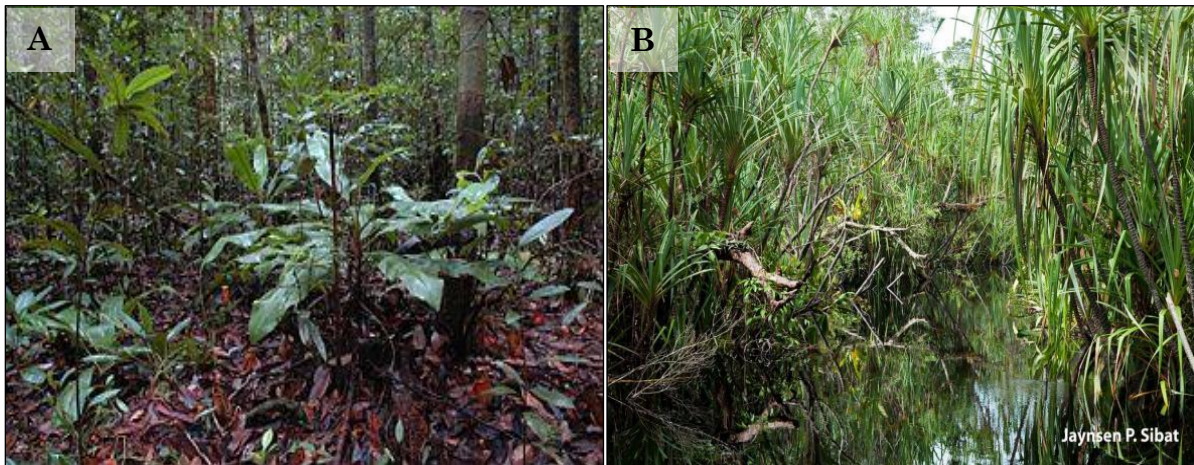


Figure 42. Peat swamp ecosystem. **A.** Peat swamp forest in Gunung Mulu NP with *Nepenthes bicalcarata* in the foreground (Photographed by Jeremiah Harris). **B.** Peat swamp forest at Maludam NP, Sarawak, Borneo (Photographed by Jaynsen Patrick)

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DABAI: THE LOCAL ‘OLIVE’ OF SARAWAK

Afiqah binti Safuani, Alyssa Pamela Jenab Anak Bundan, Bernice Anak Brain, Muhammad Iqbal bin Ishak, Musfirah binti Hj Abdul Hamid, Nor Ezrin binti Suffian, Nur Fatin Qhosimah Mohammad Jerry Azahari, Nurul Hasniatie binti Roslan, Sul Anis bin Sulaiman.

Dabai or *Canarium odontophyllum* can be found throughout the island of Borneo but is most seen in the state of Sarawak (Brooke & Lau, 2013). Although Dabai is not related to the olive family, it is also known as “Sarawak olive” because of its similarity in texture, flavour and physical appearance. This short review aimed to briefly document some of the characteristics of this unique local ‘olive’ fruit of Sarawak. Group meetings were carried out to discuss and compile related data gathered via online research and previous publications. Dabai fruit is powdery black when ripe (**Figure 43**). The shape of Dabai is oval with measurements of 3 to 4 cm long and the diameter is 1.5 to 2.5 cm. There are 75 species of Dabai throughout tropical Africa, Asia and the Pacific Island (Brooke & Lau, 2013). There are two superior clones that are highly recommended for commercial planting in Sarawak, which are Dabai ‘Laja’ and Dabai ‘Lulong’ (Brooke & Lau, 2013). Dabai is well known because of its antioxidant properties that may reduce aging signs and reduce the risk of coronary heart diseases (Anonymous, 2013). Today, Dabai is widely cultivated around the country. In conclusion, Dabai fruit is a potential fruit that provide plethora of benefits and nutrition such as magnesium and lipids.

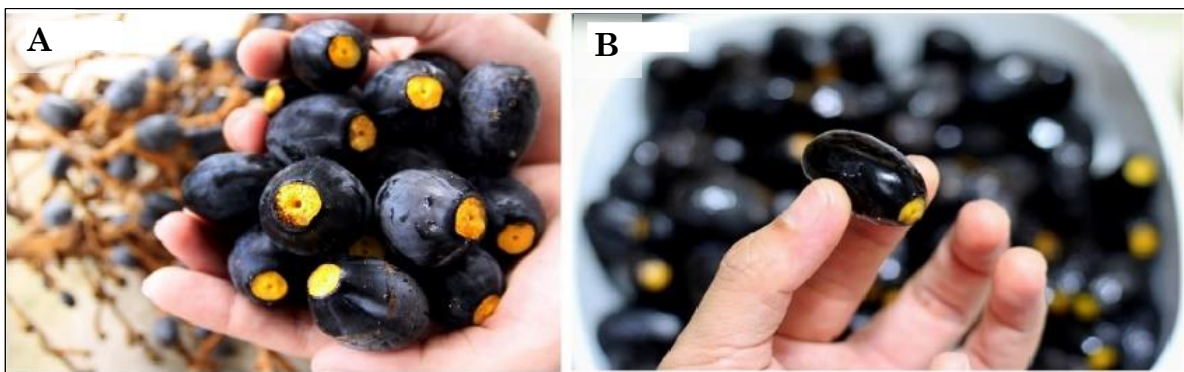


Figure 43. Dabai of Sarawak. **A.** Powdery black ripe Dabai (Afifah, 2020). **B.** Oval shape of Dabai fruit (Oakes, 2020).

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SDG 12



Responsible Consumption and Production



Designed by Maybelline Goh

ECO-BASED POTENTIAL PLANT FOR PACKAGING AROUND UNIMAS

Nuraisha Fina binti Alfian, Safwah Bazla binti Shamsudin, Mikail Adly bin Mohammad Shahrin, Nur Elysia Natasha Bt Rostam Hadi, Brigitte Chemenda Janting, Afifi Syukrina binti Rudy, Noor Asmierabinti Has, Aaron Khoo bin Khoo Hooi Kean, Dayang Siti Sarah binti Awang Madohi, Atif bin Badrolhisyam

Plastic is now the first choice of material used for packaging due to affordability. Hence, plastic waste often ends up in river, stream and sea which could cause water pollution. Many of these plastic wastes drifted to the sea causing aquatic animals like sea turtle consuming them mistakenly as food. The question is, how are we going to change our lifestyle to make this world a better place? Two plant-based packaging that can be used as eco-packaging to help save our planet was documented during the excursion around UNIMAS campus (**Figure 44**). *Musa acuminata*, banana is one of the most common plants used in packaging. People back then used banana leaves to wrap or package foods such as *Nasi Lemak* to enhance the flavour and aroma of *Nasi Lemak* and as a low-cost wrapper. Banana leaves are also used as platter back then by the Indian community. It does not pollute the environment as after used and disposed, banana leaves can degenerate as a fertilizer for other plants. *Saccharum officinarum*, sugarcane is one of the most promising plants in manufacturing eco-friendly packaging. The bamboo-like stalks of sugarcane are rich in sucrose, which is commonly used to produce jaggery. Sugarcane is also proven to be able to be an alternative for the common Styrofoam packaging. The bagasse of sugarcane is collected and transformed into pulps, which then molded into various packaging styles. Sugarcane-based packages are heat and grease resistant. They also have a multitude of eco-friendly characteristics. To summarize, sugarcane and bananas can be one of the leading plants in the eco-friendly packaging industry due to its beneficial characteristics.

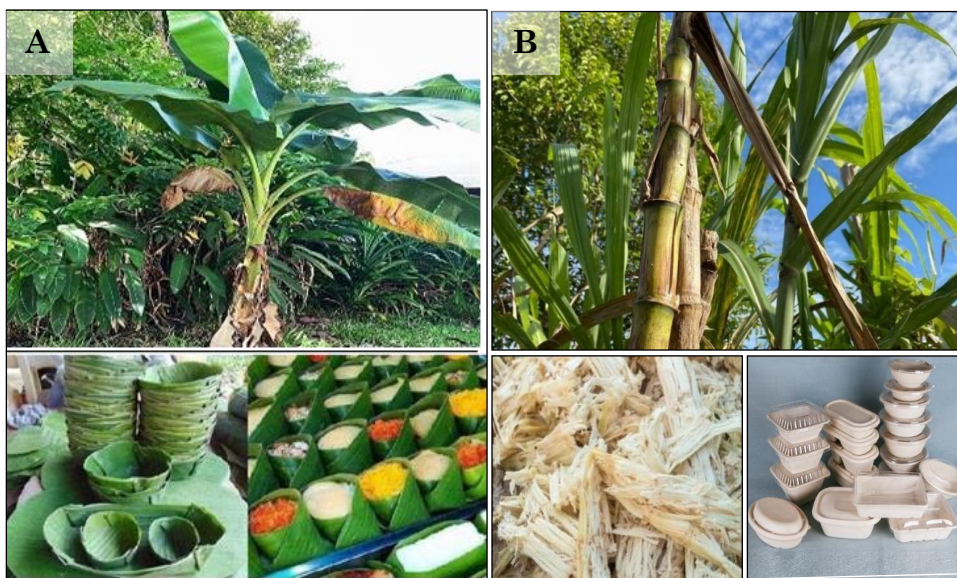


Figure 44. Example of eco-friendly plant. **A.** *Musa acuminata*. **B.** *Saccharum officinarum*

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PLANT-BASED MATERIALS FOR SUSTAINABLE PACKAGING IN UNIMAS CAMPUS

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An excursion has been undertaken at UNIMAS to study plants that have potential for sustainable packaging, or eco-packaging. The main aim of this project is to reduce reliance on the use of non-biodegradable materials as packaging and replacing them with renewable materials, primarily degradable plants. This project is crucial to educate students about the importance of preserving our environment by using fewer plastics, aside from stimulating and developing their curiosity towards plants by being able to identify its scientific name, general names, characteristics, and its functionality as eco-packaging. Plants that are commonly used as packaging includes *Cocos nucifera* or coconuts (**Figure 45**). The leaves can be woven into little baskets in which rice is cooked in. Bamboos on the other hand is a subfamily of *Bambusoideae* where in tropical, subtropical, and moderate temperate regions, they can be easily found. Its environmentally friendly features made it known as alternatives to replace paper and plastics for packaging. *Saccharum officinarum* or commonly known as sugar cane is a tall perennial grass that flourishes in warm temperature and tropical regions. Its pulp can be utilized to make eco-friendly straws, plates and bowls. Besides that, *Pandanus amaryllifolius* is a tropical plant, commonly known as screw pines. It is a monocot plant with thin parallel-veined leaves that is often used as food wrappers during baking, steaming, and grilling. This is because pandan gives out a sweet taste that indirectly adds fragrant smell and sweet taste to the food. *Musa acuminata*, *M. balbisiana*, and *M. paradisiaca*, are distinct names to address the fruit bananas. Due to the flexibility and longevity of the leaf, it is an ideal material as a protective layer for food due to its waxy surface and the leaves work well even when packing wet and greasy foods. In short, through eco-packaging, plastics and other non-biodegradable materials can hopefully be reduced when we start using plant-based materials instead. Through this trip, it is hoped that students can practice this knowledge in their daily life and future endeavours.

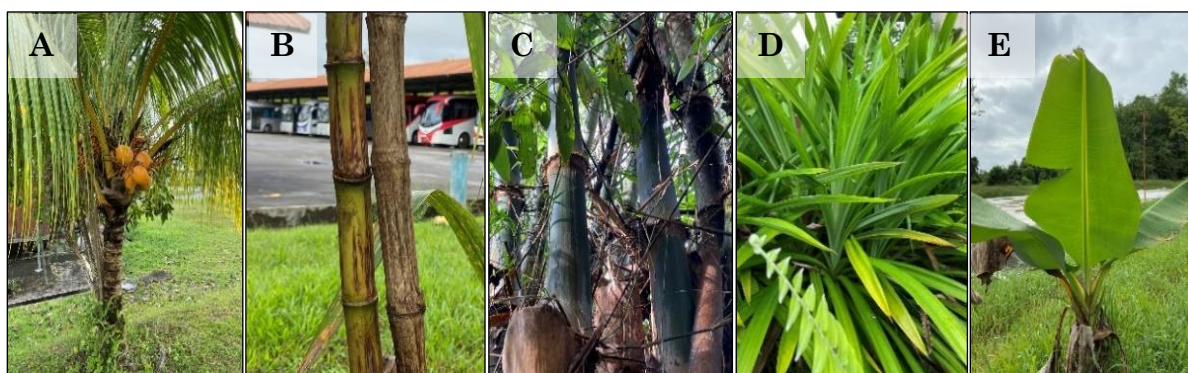


Figure 45. Example of plant-based material for packaging. **A.** *Cocos nucifera* **B.** *Saccharum officinarum* **C.** *Bambusoideae* **D.** *Pandanus amaryllifolius* and **E.** *Musa acuminata*.

PLANT-BASED MATERIAL FOR SUSTAINABLE PACKAGING IN SARAWAK

Abraham Moses Anak Dorcas, Adrian Allen Anak Biyos, Aiesyah Humairah binti Amir, Aina Tihani binti Azarul Emrun, Amira Syuhada binti Jaya, Clairra Rachel Anak Joshua, Natasha Norina Anak Rawlin, Nicholas Amos Michael, Nur Aimi Nadhirah binti Mohd Haizam, Nur Irdina Hazwani binti Mohd Zailani, and Pretty Malthasia Anak Lingeh.

“Sustainable packaging” is a form of environmentally friendly packaging. The aim of this article is to identify the species of plants that can be used in the production of sustainable packaging, specifically in Sarawak and to discuss the benefits of such forms of packaging. The plants featured in this study are the screw pines (*Pandanus tectorius*) and the pineapple (*Ananas comosus*) (**Figure 46**). The dried screw pine leaves can be used for sustainable packaging production to form various handicrafts such as baskets and carpets woven from the. Besides that, the pineapple plant also suitable to be used for sustainable packaging production as well. The leaves of the pineapple plant can be used to produce biodegradable cups and bags, as done so by the Design Centre of the Philippines (DCP) under the product name “Pinyapel”. The 100% pineapple leaves usage for the materials has resulted in the classification of pineapple leaves as sustainable packaging based on their accelerated biodegradability. In conclusion, the leaves of both species of plants were found to be suitable in producing sustainable packaging due to their eco-friendly characteristics. Due to this, the use of plastic packaging can be reduced and the use of chemicals in products such as handicrafts can be avoided.

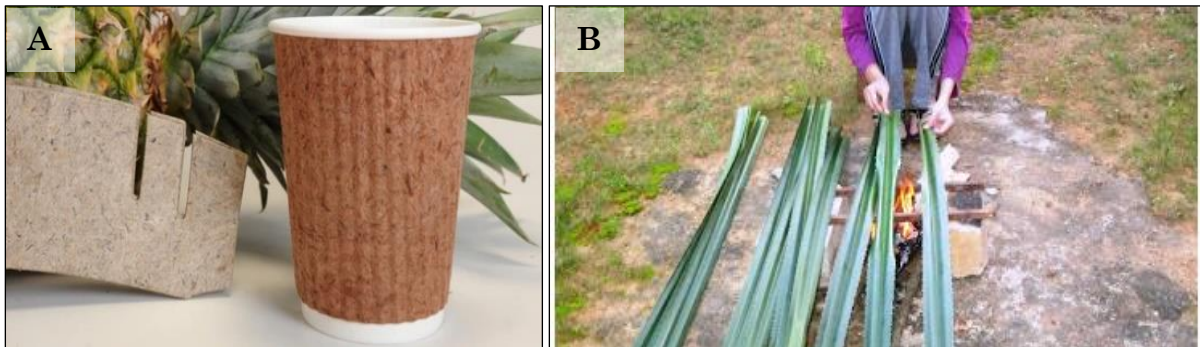


Figure 46. Example of plant-based material for packaging. **A.** Cup and cupholder made from pineapple leaves. **B.** Screw pine leaves being dried over an open flame

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SDG 6



Clean Water and Sanitation



Designed by: Maybelline Goh

THE DOCUMENTATION OF WATER QUALITY IN MAN-MADE LAKE, UNIMAS CAMPUS

Ainul Adilah binti Mohd Fadhil, Ayshah Adibah binti Nasarudin, Husna Fariah binti Hasri, Intan Nor Shafiqah binti Mohd Nizar, Mohamad Farris bin Abdullah, Muhammad Afiq Yunus bin Yahya, Nur Izzah Izzati binti Mohammad Kamarizaman, Nurul Athirah binti Hasana @ Rosna, Siti Nur Azizah binti Zamadil, Wilson Ajang

To accommodate, enhance and fulfil the course learning objectives of ecology, biodiversity and environment, it is crucial for students to understand the importance of good water quality for the environment. The specific objectives of this actual fieldwork experiment are to measure the water quality of different parameters at the man-made lake of east UNIMAS campus and to demonstrate the basic technique for the water quality assessment. This experiment was conducted at Tasik Ensurai, UNIMAS. The lake is slightly neglected and has not been well treated through the presence of water lettuce on the water surface. This lake water analysis requires multiple *in-situ* water quality parameters measurements, i.e., Global Positioning System (GPS) to determine the position; Multi-Probe to measure various parameters such as temperature and turbidity; Sling Psychrometer to measure relative humidity; pH meter to measure acidity of solution; and DO meter to measure the amount of oxygen dissolved (**Figure 47**). The parameter in the studied site shows that the pH value is low, which indicates the water is acidic and has less dissolved oxygen (**Table 5**). The trip was conducted to introduce the essential of assessment of water quality to check the suitability of a water source for the designated use.

Table 5. Data reading for each parameter for water quality observation.

Parameters	Reading 1	Reading 2	Reading 3	Mean
Temperature (°C)	28.8	29.0	29.3	29.0
Dissolved oxygen (mg/L)	4.4	4.4	4.4	4.4
Turbidity (FTU)/(NTU)	7.82	11.55	8.68	9.35
Humidity (%)	71	71	71	71
pH value	6.06	6.21	6.03	6.10

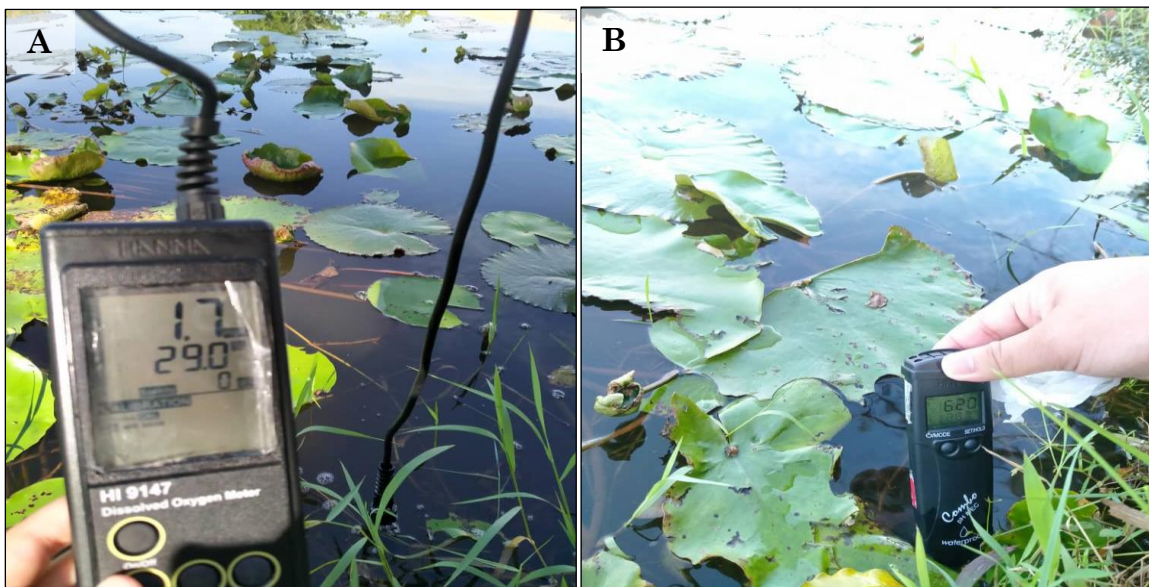


Figure 47. Instruments that used in measuring the water quality. **A.** DO meter used to measure the amount of oxygen dissolved in the lake. **B.** pH meter used to measure acidity or alkalinity of the lake.

THE DOCUMENTATION OF WATER QUALITY IN MAN-MADE LAKE, UNIMAS CAMPUS

Anis Sofea binti Osmadosnani, Azalea Honey Anak Patrick, Gloria Jane Edmund, Monique Sapong Jan, Muhammad Azib bin Azmi, Muhammad Fathullah bin Zahari, Nur Farhana Mardhiah binti Zubairi, Nurizzati Asyikin binti Misdin and Saidatul Husna binti Muhamad Taufik

To improve, and fulfil the course learning objectives in ecology, biodiversity and climate, fieldwork activity is the most important efficient way to ensure sustainable learning. Water quality documentation is the evaluation of the biological nature of the water. The water tested in this fieldwork was the UNIMAS East Campus Lake. The objectives of this fieldwork are to demonstrate basic technique for water quality assessment, to measure in-situ water chemical parameters of the lake and to measure the water quality of the UNIMAS East Campus Lake. To obtain the results below, Global Positioning System (GPS) device, multi probe, sling psychrometer, turbidity meter and dissolved oxygen (DO) meter were used. Data reading of water sample was collected from the lake for each parameter (**Figure 48**). Measurements were repeated and recorded three times and mean of each parameter was calculated (**Table 6**). Concentration of DO is important for aquatic organisms to breath and to measure water pollution. Turbidity inversely related to DO. The lower the turbidity, the higher the dissolved oxygen thus the higher water quality. In conclusion, this evaluation is important for the water quality of lake and having exposure for water quality assessment skills. Quality of the water in UNIMAS East Campus is in good and stable.

Table 6. Data reading for each parameter for water quality observation.

Parameters	R1	R2	R3	Mean
Conductivity ($\mu\text{S}/\text{cm}$)	110.3	110.5	111.0	110.6
Temperature ($^{\circ}\text{C}$)	26.5	26.5	26.5	26.5
Dissolved oxygen (mg/L)	2.9	2.5	3.0	2.8
Turbidity (NTU)	5.67	7.84	7.50	7.00
Humidity (%)	85	89	85	86
Station Coordinate(s)	N01 $^{\circ}$ 27.652 $^{\circ}$, E110 $^{\circ}$ 27.208 $^{\circ}$			



Figure 48. Students measuring the water quality at UNIMAS lake. **A.** Measuring the conductivity of water using a multi probe. **B.** Running the turbidity meter to gain the turbidity of water

AN OVERVIEW ON WATER QUALITY IN MAN-MADE LAKE, UNIMAS CAMPUS

Azra Zukrina binti Naharudin, Camilia Yen Ak Richard, Eliyana Qawima binti Kamarul, Izzah binti Ismail, Kenny Robbielia Anak Awen @ Robert Awene, Muhamad Nafis bin Abdullah, Nur Husna Syafiyah binti Mohd Hanif, Qatrunnada Faridah binti Qalam Hamidy, and Nur Aliya Athila binti Azmi

Several factors like the colour and odour of water, the presence of fish and waste products in the lake can be used to measure the water quality. There are two man-made lakes in UNIMAS Campus, the Keranji Food Court (KFC) Lake and White House (WH) Lake. Comparing the overview made between KFC Lake and WH Lake, KFC Lake is more susceptible to contamination caused by pollution (**Table 7**). The brown colour of water in KFC Lake may indicate the high concentration of debris or dirt occupying the lake water. The more dirt and debris there is in the lake, the denser the brown colour of the lake. KFC Lake is located near an outlet of a food court, and it is possible that food waste flows into the lake and contributes to the pollution of water (**Figure 49**). The waste product that is visible in KFC Lake may cause fish to be unable to live in an unfavourable environment, leading to the disappearance of fish population and mosses dominate nearshore areas. In conclusion, the water in KFC Lake contaminated due to its transparency of water, which is darker than WH, followed by the absence of fishes in KFC. Further investigation is needed to prove the findings in this overview.

Table 7. Comparative description between Keranji Food Court (KFC) Lake and White House (WH) Lake

Description	Keranji Food Court	White House
The colour of water	Brown	Colourless
Water Odour	Odourless	Odourless
Fish Present [No/Yes]	No	Yes
Waste Product	Food containers and drink can	Food containers and drink can
Other observation	Outlet from a nearby cafe	Drainage channel into the lake



Figure 49. Lake of UNIMAS East Campus. **A.** Keranji Food Court Lake. **B.** White House Lake.

SDG 3



Good Health and Well Being



Designed by Maybelline Gor

THE OBSERVATION OF MEDICINAL PLANTS IN UNIMAS CAMPUS

Addlyka Jatek Lai, Aliff Syahmi A Raeff, Hajj Atthira Ibrahim, Ivy Olivia Luka, Mohd. Hairul Adha Hamdan, Nur Aida Husna Ab Halim, Nur Fathiyyah Mawardi, Simon Dattan Jihek, Siti Soleha Karim, and Mohamad Fhaizal Mohamad Bukhori

UNIMAS are blessed with culture and surrounded by nature. Therefore, learning, and documenting biodiversity, ecology, and environment are relevant and significant. Objectives of the activity are to reinforce experiential and contextual learning, to expose students to nature and new environment, and to offer students a unique cultural learning experience. The activity was conducted around East Campus of UNIMAS to do observation of medicinal plants around the campus. Pictures of the plants were capture followed by analysing the data by referring to the established reference. Among the plants recorded are aloe plant or commonly known as aloe vera, *Hymenocallis speciosa*, *Orthosiphon aristatus*, *Cymbopogon citratus*, and *Stenochlaena palustris* (**Figure 50**). Aloe plant was chosen to be further describe because it is an established and well-known medicinal plant that has been used to treat various health conditions since many decades ago (Figure A and B). The botanical name is *Aloe barbadensis*. Aloe vera is gel from the leaves of the plants (Figure C). The plant belongs to Asphodelaceae family. It is a shrubby, perennial and pea-green colour plant. The plant was known and used for centuries for health, beauty, medicinal, and skin care properties. Some of the benefits are to accelerate wound healing, reduce dental plaque, treat canker sores, improve skin texture, prevent wrinkles, and improves digestive health. This is because aloe vera contains antioxidants such as Vitamins A, C, E, and beta carotene. In nature, medicinal plants have various benefits in curing and avoiding the enormous health complications that might harm lives. Practicing on substituting chemical supplements into medicinal plants or herbs as supplements could enhance the quality of health although many would not prefer as the technology keeps on developing. However, medicinal plants have ensured its safety towards humans' health and its nature characteristics lead to a better environment. Finally, the medicinal plants should be promoted as it helps in reducing the possibilities of treacherous health complications that might be caused by chemically synthetic supplements.

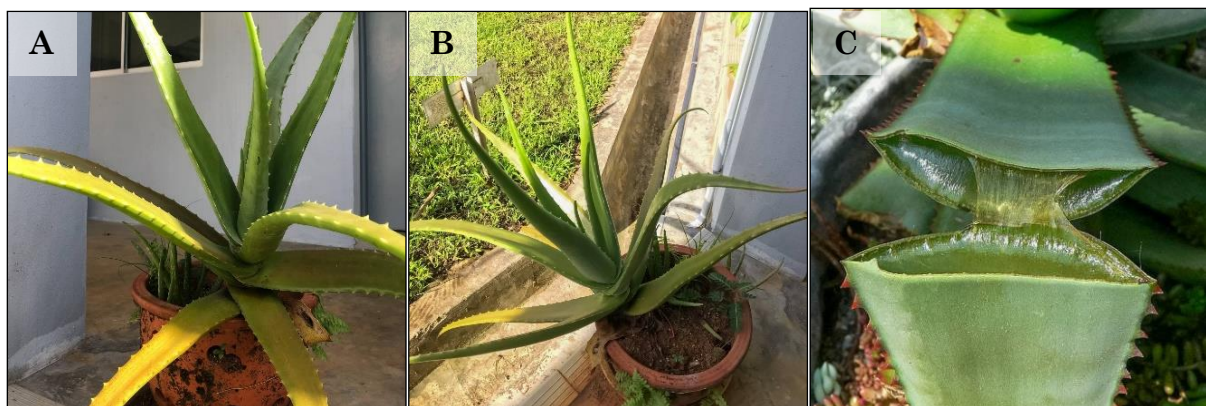


Figure 50. Aloe vera. **A.** Top view of the plant **B.** Side view of the plant **C.** Midsection of aloe plant leaves.

THE OBSERVATION OF MEDICINAL PLANTS IN UNIMAS CAMPUS

Afiqah Hana Sharihan, Eddrie Rugu Westane, Hafizah Abdul Majid, Idhzam Ittishal Zayeed Imran, Judith John, Misha Aren James, Nur Izzatul Jannah Rosman, Schavera Elyiot Junik, and Mohamad Fhaizal Mohamad Bukhori

UNIMAS are blessed with culture and surrounded by natural surroundings. Therefore, learning, and documenting biodiversity, ecology, and environment are relevant and meaningful. Objectives of the activity are to reinforce experiential and contextual learning, to expose students to nature and new environment, and to offer students a unique cultural learning experience. The activity was conducted around East Campus of UNIMAS to do observation of medicinal plants around the campus. Pictures of the plants were capture followed by analysing the data by referring to the established reference. Among the plants recorded are *Centella asiatica* and *Cestrum nocturnum* (**Figure 51**). These medicinal plants were recorded to provide health benefits and usage. *Centella asiatica* was recorded originally from Indian subcontinent, Southeast Asia, and wetland regions. Various medicinal compounds recorded from the plants including pentacyclic triterpenoids, asiaticoside, brahmoside, and several other constituents. *Centella asiatica* is also referred to as the herb of longevity, as it has benefitted human cognitive function, to treat mild wound as it contributes to the regeneration rates of the skin, and various diseases such as cardiovascular, anxiety, and rheumatism. However, it may become poisoning with a significant side effect on the body rather than curing in high intake of the plant. *Cestrum nocturnum* is also referred to as the lady of the night. The plant is an evergreen woody shrub that grows as an ornamental plant in the subtropical regions. The flowers are heavily scented during the night may have been the reliable explanation for becoming the lady of the night. Studies have shown that numerous bioactive phytoconstituents recorded in the plants such as alkaloids, flavonoids, glycosides, hormones, phenols, and essential oils. The plants are benefitted in wound healing by increasing epithelialization rate and preventing secondary bacterial infection that can lead to complicated and delayed wound healing.



Figure 51. Examples of medicinal plant species. **A.** *Centella asiatica* **B.** *Cestrum nocturnum*

SDG 7



Renewable and Clean Energy



Designed by: Maybelline Goh

THE BORNEO PROJECT: BAKUN AND MURUM DAM

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Bakun Hydroelectric Dam in Sarawak is one of the world's highest concrete rock-filled dams, together with the Murum Dam which is a gravity dam located at the Murum river, Sarawak. The objective of this research was to identify the implications of the developed dams towards the ecosystem. Steps taken to conduct this bulletin were online research methods and information were collected solely via articles, web page and journals from the Internet. Although Malaysia succeeded in developing the Bakun and Murum dams in order to increase the electricity efficiency in Sarawak, it is undeniably devastating knowing that the construction of the dams involved a complete and irreversible destruction of 69, 640 ha of old forest ecosystem (**Figure 52**). Not only that, it also causes disturbance that affects the organisms that are adapted to specific flooding regimes. In conclusion, mega-dams are often touted as a means of 'green energy' even though it has greatly affected the nature surrounding it while implementing the demand and supply initiatives to the population.



Figure 52. Dam in Sarawak. **A.** Bakun Dam taken by The Star, 2010. **B.** Murum Dam taken by UNIMAS, 2015.

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