



# International Conference on Biodiversity

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# ABSTRACT

## INTERNATIONAL CONFERENCE ON BIODIVERSITY

**SOCIETY FOR INDONESIAN BIODIVERSITY**

Surakarta, 22 October 2022





# ABSTRACT

## INTERNATIONAL CONFERENCE ON BIODIVERSITY

SOCIETY FOR INDONESIAN BIODIVERSITY

Surakarta, 22 October 2022

THEME:

Conservation and Sustainable Use of Tropical Wetlands Biodiversity

### SECRETARIAT ADDRESS

Sekretariat Masyarakat Biodiversitas Indonesia, Kantor Jurnal Biodiversitas, Gedung Pascasarjana Lt. 5 Universitas Sebelas Maret Surakarta, Jl. Ir. Sutami 36A Surakarta 57126, Jawa Tengah, Indonesia. Tel. +62-822 2649 8910. Email: [biodiversitas@gmail.com](mailto:biodiversitas@gmail.com). Website: <https://events.smujo.id/e/international-conference-202209/>

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**TIME SCHEDULE**  
**International Conference on Biodiversity**  
**Society for Indonesian Biodiversity (SIB)**  
**Surakarta, Indonesia, 22 October 2022**

<b>TIME</b>	<b>ACTIVITIES</b>	<b>PERSON IN CHARGE</b>	<b>SITE</b>
<b>Time in Jakarta, Indonesia</b>			
<b>October 22, 2022</b>			
<b>07.30-08.00</b>	Registration	Committee	Lobby
<b>08.00-08.30</b>	Opening ceremony - Indonesian National Anthem - Pray - Message from SIB ( <b>Dr. Joko Ridho Witono, M.Si.</b> )	Committee	Main Room
<b>08.30-09.15</b>	Panel I <b>Prof. Dr. Dwi Astiani, M.Sc.</b> (Universitas Tanjungpura, Indonesia)	Moderator: <b>Elisa Herawati, M.Eng., Ph.D.</b>	Main Room
<b>09.15-10.00</b>	Panel II <b>Prof. J. K. Garg (Guru Gobind Singh Indraprastha University, India)</b>		
<b>10.00-11.30</b>	Parallel presentation		
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	Group 2: <b>A-08 to B-04</b>	Moderator: <b>Prof. Yosep S. Mau, Ph.D.</b>	R2
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Note: A. Genetic Diversity, B. Diversity of Species, C. Diversity of Ecosystem, D. Ethnobiology and Socioeconomics, E. Bioscience (Life Science and Technology); O. Oral.

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## ABSTRACT

### International Conference on Biodiversity Society for Indonesian Biodiversity (SIB) Surakarta, Indonesia, 22 October 2022

#### Genetic diversity

##### A-01

#### Isolation of probiotic and antioxidant from local honey West Sumatra, Indonesia

Adli Hadiyan Munif<sup>1</sup>, Sumaryati Syukur<sup>1</sup>, Armaini<sup>1</sup>, Henny Herwina<sup>2</sup>, Anwar Kasim<sup>3</sup>, Epi Supri Wardi<sup>4</sup>, Aliyah Fahmi<sup>5</sup>

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<sup>4</sup>Faculty of Pharmacy, Universitas Perintis. Batipuh Panjang, Koto Tengah, Padang, 25586, West Sumatra, Indonesia

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The isolation and characterization of a local honey named Galo-Galo Honey (GGH) from West Sumatra, Indonesia have been conducted. In this study, four Lactic Acid Bacteria (LAB) isolates were isolated, then characterized microscopically and biochemically. LAB from GGH (GGH-LAB) isolates were Gram-positive coccobacilli, diplobacilli, streptobacilli, palisades; catalase-positive, and heterofermentative. From the antioxidant activity test with the DPPH method, consuming GGH with 7.87% concentration could inhibit free radical DPPH. All isolates of GGH-LAB also showed good and very good resistance toward acid resistance test and bile salt tolerance test. Whereas for the antibacterial activity assay, it can be concluded that the most resistant isolate is isolate 4, which

has the biggest holozone (*E. coli* 4.7 mm and *S. aureus* 2.64 mm) compared to other isolates of GGH-LAB. The DNA from isolate 4 then will be isolated for molecular identification.

Antibacterial activity, antioxidant DPPH, galo-galo honey, lactic acid bacteria

*Aegicerias corniculatum*, DNA barcoding, mangrove, phylogenetic tree

##### A-02

#### Increasing the population of kacang goats by utilizing the potential of triplets

Ning Setiati<sup>1</sup>, Abyadul Fitriyah<sup>2</sup>, Priyantini Widyaningrum<sup>1</sup>, Dyah Rini Indriyanti<sup>1</sup>

<sup>1</sup>Universitas Negeri Semarang. Sekaran, Gunung Pati, Semarang 50229, Central Java, Indonesia

<sup>2</sup>Universitas Nahdlatul Wathan Mataram. Jl. Kaktus No.1-3, Gomong, Mataram 83126, Nusa Tenggara Barat, Indonesia

The population of cattle and goat must be increased as the consumption of meat increases from year to year. This study aims to increase the population of local kacang goats by utilizing the potential of triplet. This study used both Local Kacang goats with triplets and single kids consisting of four (4) Local Kacang goats with 12 triplets and four (4) Local Kacang goats with four (4) singletons. The variables observed included body weight (BW), body length (BL), shoulder height (SH) and chest circumference (CC) as well as levels of FSH and LH hormones in the blood. Measurements were also made of the temperature and humidity of the goat sheds and surroundings. The data were analysed using t-test and explained descriptively. Triplets-Local Kacang goats (TLKG) showed lower reproductive performance than Single-Local Kacang goats (SLKG), with the following comparison: the average of BW (kg) = 40.14±9.69 vs 48.85±10.15; BL (cm) = 64.05±5.29 vs 68.65±5.40; SH (cm) = 53.15±4.20 vs 56.85±5.40; CC (cm) = 51.85±5.52 vs 65.35±6.47 with no significant body temperature, that is 80.20±7.45 OF (TLKG) and

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**Note:** In order to avoid improper conduct of third parties against authors by using email addresses, starting on 2018 correspondence emails (♥) are not listed. Colleagues can communicate with the author by mail or contact us at biodiversitas@gmail.com

82.75±8.47 0F (SLKG). Meanwhile, the results of measurements of hormone levels (mIU/ml) of FSH and LH in the blood of TLKG significantly ( $P<0.01$ ) increased compared to the blood of SLKG, namely FSH = 1,42±3,08 vs 1,36±3,06 and LH = 1,12±2,12 vs 1,05±2,09. In the kid, did not appear to be a significantly different between reproductive performance in triplets (T) and singletons (S).

Local Kacang goat, population, triplets

### **A-03**

#### **Antibacterial and antioxidant activity test of indigenous yeast of tomato waste against *Staphylococcus aureus* and *Escherichia coli***

**Gemilang Lara Utama, Nadya Natiqoh, Meli Puspita Sari**

Faculty of Agro-Industrial Technology, Universitas Padjadjaran. Jl. Raya Bandung-Sumedang Kilometer 21, Jatinangor, Sumedang 45363, West Java, Indonesia

Tomato (*Lycopersicon esculentum*) is a very abundant agricultural commodity, sometimes tomatoes are underutilized, causing rotten and damaged tomatoes. Damage to tomatoes can be caused by microorganisms and chemical factors. The purpose of this study was to determine the potential of indigenous yeasts in tomato waste as antibacterial and antioxidant against *S. aureus* and *E. coli* bacteria. The research method used in this study The antibacterial activity test was carried out by the diameter of the clear zone with the plug method. Bacterial viability was tested on indigenous yeasts from tomato waste using the TPC (Total Plate Count) method. Antioxidant activity of yeast metabolites were tested using the DPPH method. The results of the identification of indigenous yeasts contained in tomato waste, namely *Blastoschizomyces capitatus*, *Candida krusei* (1), *Candida krusei* (2), and *Saccharomyces cerevisiae* have antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*. Testing the antibacterial activity of indigenous yeasts based on the formation of the highest clear zone diameter was found in *Saccharomyces cerevisiae* against *Escherichia coli* and *Staphylococcus aureus*. Metabolite yeast indigenous tomato waste has antioxidant activity which is classified as very weak with an IC50 value of 35001.64 ppm.

Antibacterial, antioxidant, *Escherichia coli*, *Staphylococcus aureus*, yeast

### **A-04**

#### **Isolation and identification of candidate probiotics from traditional fermented soybean (tauco)**

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Tauco is a traditional Indonesian fermented food made from soybeans which undergoes two stages of fermentation (mold fermentation and salt solution fermentation). One of the microorganisms that play a role in the formation of the distinctive color and taste during the tauco fermentation process is yeast. This study aims to identify the type of yeast in tauco products that have the potential as probiotic microorganisms. The research was conducted using an experimental method with descriptive analysis. The tauco used in the study was tauco obtained from Cianjur under the brand name 'Tauco Cap Ny Meong'. Observation parameters include the isolation and identification of yeasts macroscopically, microscopically, and molecularly (TPC testing) and testing for resistance to acid conditions, testing for resistance to bile salts, as well as testing the aggregation ability against pathogenic *E. coli*. The yeast that was isolated from the tauco sample was a yeast coded B1 which had a 100% similarity with *Candida glabrata* UZ-593-16. The potential of yeast *C. glabrata* B1 as a probiotic was tested by its resistance to acid to extreme pH (pH 2), bile salts to critical concentrations (5%), and aggregation of *E. coli* which showed positive results with increasing observation time.

Isolation, probiotics, tauco, yeast

### **A-05**

#### **SARS-CoV-2 genetic variation and bacterial communities of COVID-19 patients aged ≥40 in West Java, Indonesia**

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COVID-19 impact in Indonesia has been severe and rapidly spreading as reflected by Indonesia's total COVID-19 cases. In response to the growing threat, we conduct SARS-CoV-2 genomic surveillance and investigate nasoro-pharyngeal bacterial communities of middle-aged and elderly patients (≥40 y.o.) in West Java as dysbiosis of upper respiratory tract (URT) microbiota could worsen patient clinical condition. We utilize the Nanopore sequencing platform to analyze 43 samples of SARS-CoV-



2 genetic variation and 11 selected samples for 16S rRNA gene sequencing which was collected in May-August 2021. Results showed five virus lineages in the populations (AY.23, AY.24, AY.26, AY.42, B.1.1.7) which was dominated by the prevalence of AY.23 (>82%). The most mutated region in the SARS-CoV-2 genome was S protein (>20%). There was no association between SARS-CoV-2 lineages, mutation frequency, patient profile, and COVID-19 rapid spread-categorized cases. There was no association of bacterial relative abundance, alpha and beta diversity, and LEFSe analysis with patient profile and rapid spread cases. MetagenomeSeq analysis shows eight differential abundance species in certain patient profiles, including *Pseudomonas aeruginosa* and *Haemophilus parainfluenzae*. The data implies relevant AY.23 domination (VoC delta) in West Java with global infection in that time frame so the surveillance program is proven extremely important to monitor disease progression. The bacterial communities show diverse results which suggest different micro-environment in each patient and complex multifactor may be involved in the bacterial-induced disease progression.

16S rRNA sequencing, bacterial community, COVID-19 rapid spread, Oxford Nanopore Technologies, SARS-CoV-2 variants

## A-06

### Identification of salak cultivars based on RAPD Markers

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Salak (*Salacca zalacca*) is one of tropical fruit plant that is found in almost every region in Indonesia. Various genetic information of salak is needed as a source of information for further development of salak. This study aims to determine the differences in molecular characters and levels of polymorphism in five salak cultivars based on RAPD markers and to find salak cultivars that can be recommended as parents for further breeding of salak. The salak cultivars used in this study were Kersikan, Genjah, and Tempuran (Pasuruan), Suwaru (Malang), and Pondoh Pronojiwo (Lumajang). Young leaves from each salak cultivar were taken for RAPD analysis using three primers (OPA-11, OPA-17, OPA-18). The results of the RAPD analysis showed that the five salak cultivars had different molecular characteristics by forming 3 groups, namely (1) the Suwaru salak group and the Pondoh salak, (2) the Genjah salak group, and (3) the Kersikan salak group and the Tempuran salak. The polymorphism rate of salak cultivars was about 77.78%. Of the five cultivars of salak, the Genjah salak cultivar has the most different molecular characteristics from other cultivars so that the Genjah salak

cultivar can be recommended to be the elder of salak breeding.

Polymorphism, RAPD, *Salacca zalacca*, Salak

## A-07

### Phylogenetic relationship of gerong kuwe fish and yellow kuwe fish at Youtefa Bay Waters, Jayapura, Papua, Indonesia using DNA barcoding technique

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Trevally fish (*Caranx* spp.) or Kuwe fish (local name) are small pelagic fish that are mostly caught in the waters of Youtefa Bay. There are two types of Kuwe fish that are difficult to distinguish due to morphological similarities. These Kuwe fish have no scientific species identification so they have several different local names. Accordingly, it is necessary to identify and find out the proper naming of the two Kuwe fish. DNA barcoding is a technique used to speed up and simplify the process of identifying organisms. Hence, the purpose of this research was to identify the proper scientific name of the two Kuwe species in Youtefa Bay waters, as well as the kinship between these two types by applying a DNA barcoding technique. Nineteen Kuwe fish were sampled at Youtefa Bay, Jayapura, Papua in July 2022. Samples were studied morphologically, then carried directly to the Integrated Laboratory of Diponegoro University for molecular studies. DNA extraction, amplification, and DNA sequencing were carried out to further validate the species' identification. The results showed that the relationship between length and weight of *Caranx sexfasciatus* and *Caranx tille* have resulted in  $b = 2.5754$  with  $R^2 = 0.8564$  and  $= 1.7119$  with  $R^2 = 0.6705$ , respectively. The BLAST analyze demonstrated that 10 samples were closely related to *Caranx sexfasciatus* (99%-100% in similarity) and 9 samples were similar to *Caranx tille* (97%-99%). The genetic distance between individuals in *Caranx sexfasciatus* and *Caranx tille* has a value ranging from 0% - 0.2%, and the phylogenetic tree exposed that the two species have separate clades. This study revealed that there are two species of Kuwe fish (*Caranx sexfasciatus* and *Caranx tille*) in Youtefa Bay, Papua, Indonesia.

*Caranx* spp, DNA barcode, morphometry, Papua, Youtefa bay

## A-08

### Assessment of genetic diversity and characterization of distinctness, uniformity, and stability of newly bred clones and check varieties of sweet potato based on morphological characters

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Genetic diversity assessment is vitally important for germplasm management and the assembly of new varieties. This study aimed to 1) assess the genetic diversity and 2) characterize the distinctness, uniformity, and stability of newly bred clones and check varieties of sweet potatoes based on morphological characters. The present study was performed out in the experimental farm of Universitas Nusa Cendana for two cycles (years) in 2021 and 2022, involving 13 newly bred (hybrid) clones and 6 check varieties. The observations were made on morphological characters of leaf, vine, and storage root, including 31 characteristics. The observed characters were given scores based on the sweet potato descriptors of IPGBR and PPVTPP. The scored morphological data were subjected to cluster analysis followed by a Principal Component Analysis to reveal the genetic diversity level. Euclidean index was used to characterize the distinctness, while the variation of the scored morphological data was used to reveal the uniformity and stability of tested genotypes. The results revealed a high genetic diversity of the studied genotypes. The cluster analysis placed the studied genotypes into four clusters; cluster I consisted of only one genotype, cluster II comprised two sub-clusters and 13 genotype members, cluster III comprised two members, and cluster IV comprised two sub-clusters and three members. The first eight principal components were responsible for about 79% of the observed variability. Euclidean distance index revealed that each of the studied genotypes is distinct from others. No off-type plant was observed; thus, each of the tested genotypes was considered uniform. Phenotypic expressions of the studied genotypes were similar over the two growing cycles; thus, each is said to be stable. The newly bred genotypes that meet the distinctness, uniformity, and stability criteria are eligible for registration as new sweet potato varieties.

Cultivar, divergence, qualitative, sweet potato, traits

## **A-09**

### **DNA primer design for sex identification of Sumatran tigers**

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Seized from illegal trade need to be identified with the help of molecular methods to ensure the profile of the confiscated samples including the determination of their sex. Molecular gender identification can be done by amplifying the amelogenin gene. The results of gender identification of Sumatran tiger samples based on the primers of previous researchers stated that the amplification bands of amelogenin X (AMELX) and amelogenin Y (AMELY) in male samples were difficult to distinguish because the difference in length of their DNA was only 20 base-pairs. The difficulty of distinguishing these bands resulted in errors in detecting male and female individual samples. Thus, it is necessary to design a more specific primer as a way to avoid this error. The purpose of this study was to design a primer for sex identification of the Sumatran tiger based on the sequence of nucleotide bases in the introns of the amelogenin gene and to compare the primer designed with primers that have been previously reported. The research was carried out using descriptive methods and molecular observation of the AMELX and AMELY Sumatran tiger sequences. The primer design results in this study can identify the sex of the Sumatran tiger sample. The primer design result is a primer that is more specific than the primers previously reported.

Amelogenin gene, intron, *Panthera tigris sumatrae*, primers design

## **A-10**

### **Characterization of morphological and agronomic of several genotypes of upland rice (*Oryza sativa* L.) from Sumatra, Indonesia**

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Upland rice is one of the rice that should be preserved as germplasm because it has the potential to be planted on marginal land. Marginal land in Indonesia is quite extensive. One of the efforts that can be done is the characterization of upland rice. The upland rice observed was a genotype from Sumatra. The research used a Completely Randomized Design (CRD) with totaling 450 plants. The data obtained are shown in the form of the mean of each observation variable. Furthermore, to distinguish each genotype of upland rice, cluster analysis was carried out which was displayed in the form of a dendrogram. Based on dendrogram, it can be seen that, based on the 80% dissimilarity of characters obtained there are three groups, group one consists of genotypes Santap Raja and Simandailing, group two consists of Sipulut Gogo, Siasona, Simayang, Siremet, Padi Alim, Padi Ladang Pasaman, Sidukkal Dekkil and group three only consists Lumut Paon. These results show that there are several genotypes that have a distant relationship and this information is very necessary for breeders to produce new varieties through breeding the higher the difference between genotypes, it is possible to get new superior varieties.

Characteristic, diversity, genera, upland rice

## Diversity of Species

### B-01

#### Environmental DNA (eDNA) pilot project reveals high diversity of gobies (Gobiiformes) around Banggai Island, Central Sulawesi, Indonesia

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The Banggai Marine Protected Area (MPA) in Central Sulawesi, Indonesia, established in 2018, is not yet fully implemented and lacks comprehensive biodiversity data. Challenges include limited taxonomic expertise and funding, while some taxa can be missed and/or hard to identify using classical visual census methods. This study, part of an environmental DNA (eDNA) pilot project on fish biodiversity around Banggai Island, focussed on gobies (Gobiiformes). Environmental DNA (eDNA) seawater samples were collected in October 2018 at four sites (three replicates/site). After eDNA extraction (Bionesia in Bali), metabarcoding (MiFish 12S Teleost primers), sequence library preparation (Barber Lab, University of California Los Angeles), and high-throughput sequencing (Nextseq), the data generated were aggregated into amplicon sequence variants (ASVs) followed by taxonomic assignment using the Anacapa toolkit. The 244 Gobiidae ASVs over 100 bp long were assigned to two families (Gobiidae and Eleotridae), 33 genera and 52 species-level taxa, with between site variation. Our results reveal high gobiid biodiversity, and reinforce the need for effective management of the fledgling Banggai MPA to conserve the still poorly known biodiversity; however, the goby ASVs not assigned to species at 90% (59%) or 60% (30%) confidence levels highlight a need for specimen collection and barcoding in this region.

Gobiidae, Eleotridae, MiFish Teleost primers, SDG 14 Life under water, marine protected area

### B-02

#### Exploration of orchid in the Bukit Karamunting, Limau Manis, Padang, West Sumatra, Indonesia

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Orchid is the most popular flower in Indonesia. Orchid has very diverse and unique characters. Natural orchids are useful as parent materials for hybridization of orchid. To get natural orchid, it is necessary to do exploration. This research was conducted by survey using the line transect method. Orchids exploration were carried out on the sides of the 10 m wide left and right lane at the Bukit Karamunting with an area of around 25 hectares from June to September 2022. The study was carried out by determining the coordinates of the location of orchids and identifying orchid species by observing the morphology of orchids according to several orchid species books. The results showed that there were 82 orchid locations consisting of 25 species and 15 genera. The dominant orchid in this area is *Dendrobium crumenatum*. In this area there is a rare natural orchid, namely *Papilionanthe* sp. There is also found the largest orchid in the world, namely *Grammatophyllum speciosum*. In addition, there is also orchid with the smallest flowers in the world, namely *Oberonia* sp.

Characteristics, diversity, genera, orchid, species

### B-03

#### Ecosystem health assessment and carbon stock estimation of seagrass meadow in Mengiat Beach, Nusa Dua, Bali, Indonesia

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Indonesia's seagrass meadows are highly relevant in the context of global blue carbon storage. However, research regarding seagrass ecosystems, especially at the site level in Indonesia remains limited. An example of a site with significant potential for seagrass is Mengiat Beach, Nusa Dua, Bali which is known to have a relatively large area of seagrass meadow, but is severely impacted by anthropogenic activities due to its popularity as a tourist destination. This research aims to describe the seagrass community, determine the health status, as well as to estimate the carbon stored within the seagrass meadow in Mengiat Beach. Biotic data were collected from 6 100m transects with the aid of quadrat plots. Dominant seagrass species in the meadow was determined using Important Value Index (IVI). Ecosystem health status was determined using Seagrass Ecological Quality Index (SEQI) Seagrass meadow extent was estimated using spatial analysis of Sentinel-2 satellite data with unsupervised classification.

Carbon storage both from the sediment and biomass were calculated using loss on ignition (LOI) method. Results from this study recorded a total of five seagrass species in Mengiat Beach, dominated by *Cymodocea rotundata*. In total, the seagrass cover of this site was estimated to be 60.7%, with seagrass density of 588 shoots/m<sup>2</sup>, and epiphyte and macroalgae cover were estimated to be 26.16% and 4.76%, respectively. SEQI value was calculated to be 0.69, indicating that the ecosystem is in good condition. Results from spatial analysis estimated the seagrass meadow extent in Mengiat Beach to be 43.21 ha. Carbon stored was estimated to be 132.37 MgC/ha, 0.39 MgC/ha and 0.56 MgC/ha in sediment (extrapolated to the depth of 1m), aboveground biomass (AGB) and belowground biomass (BGB) compartments, respectively. Extrapolated to the extent of the seagrass meadow in Mengiat Beach, the whole site was estimated to store as much as 5.76 GgC from all carbon reservoir compartments combined.

Blue carbon, ecosystem health assessment, seagrass meadow, SEQI, spatial analysis

#### **B-04**

##### **The relationship between artificial reef stars cluster area and reef fish assemblage in Mengiat Beach Nusa Dua, Bali, Indonesia**

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Coral reef ecosystems contain high biodiversity and provide numerous ecosystem services, yet these ecosystems are facing local and global threats which lead to degradation; thus, restoration efforts are required. Indonesia Coral Reef Garden (ICRG) program in Mengiat Beach Nusa Dua, Bali, has implemented artificial Reef Stars structures for restoration. This study aims to examine the relationship between Reef Stars cluster area and reef fish species richness, and to analyse the dichotomy between single large or several small (SLOSS) areas in influencing species richness. The number of species and abundances were surveyed using UVC stationary point count method at 30 Reef Stars clusters (2.36-99.42 m<sup>2</sup>) for four periods (5 minutes/period). During the first period, only species data were recorded, while their abundances were counted in subsequent periods. Species-area relationship (SAR) models were fitted to the data to determine the best-fitting model based on AICc value and LEE value. This study demonstrated that the Kobayashi, logarithmic, and power models are the best in explaining SAR in this study, respectively. Model averaging based on those three models could produce a new model with better extrapolation capability. The average of actual total species richness (54.3 species) across 30 clusters with a total area of 540.21 m<sup>2</sup> was much higher than the extrapolated species richness (35.5 species) of an equivalent area. The present study suggests that the configuration of 30 small

Reef Stars clusters could hold more species than a virtual single large Reef Stars cluster of equivalent total area and 20-40 m<sup>2</sup> were the optimal cluster size for initial reef restoration.

Artificial reefs, reef fish, single large or several small, species-area relationship, species richness

#### **B-05**

##### **Characterization of lactic acid bacteria isolated from Pado Fish from Agam District, West Sumatera, Indonesia**

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Pado is a typical fermented fish from West Sumatra with a mixture of Simauang seed meat (*Pangium edule* Reinw) and coconut dregs wrapped in plastic for 4 to 8 days. Pado has good nutritional value and is thought to have a lactic acid bacterial activity used as a probiotic-producing functional food. This study aims to determine the total colonies of lactic acid bacteria (LAB), biochemical properties of LAB, antimicrobial activity of LAB, acid pH resistance, bile salt, isolation, and identification of LAB types found in Pado fish molecularly by using the 16S rRNA method. The research method is a descriptive and laboratory analysis methods. The sample used as material for this research is Pado fish from 3 Pado fish sellers (P1, P2, P3) in Agam Regency, in the province of West Sumatra. The results showed that the characteristics of Pado were catalase-negative and homofermentative. The results of the Gram staining were rod-shaped and purple (Gram-positive). The total colonies of Pado lactic acid bacteria ranged from 20x10<sup>9</sup>-257x10<sup>9</sup> CFU/gr. The bacteria from the 16S rRNA Pado P2 sample was *Lactobacillus plantarum* strain SRCM 102737.

16S rRNA, Lactic Acid Bacteria, *Lactobacillus plantarum* Pado, probiotics

#### **B-06**

##### **Diversity of amphibian in tropical peatland (case study: Buffer area of Orang Kayo Hitam Forest Park, Jambi, Indonesia)**

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Peatlands are fragile to fire, causing ecological damage that threatens biodiversity, one of which is amphibians. The nature of amphibians that are sensitive to environmental



changes can be used as bioindicators of disturbing environmental quality such as post-burned land. This study aims to analyze the amphibian diversity index. The method used is the Visual Encounter Survey (VES) and analyzed using the Shannon-Wiener diversity index. There are six types of amphibians, namely *Hylarana erythraea*, *Hylarana nicobariensis*, *Fejervarya limnocharis*, *Fejervarya cancrivora*, *Duttaphrynus melanostictus*, and *Hylarana glandulosa*. The Shannon Wiener diversity index is moderate with a value of H': 1.53. This shows that ecologically the habitat conditions in the buffer villages around the Orang Kayo Hitam Forest Park can support the life of amphibian species.

Amphibian, diversity, peatland

### **B-07**

#### **Species nova of *Curcuma* (Zingiberaceae) from the Southern Western Ghats, India**

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The genus *Curcuma* L. is one of the largest genera in the Zingiberaceae, about 147 species distributed throughout Tropical Asia from India to South China, Southeast Asia, Papua New Guinea and Northern Australia. It is of great economic and ornamental importance mostly grows well in loose and sandy soil in shaded areas. In India, 45 species have been so far reported; most of them were distributed in south India. Out of it 18 are endemic species, seems India as a one of the possible centers for evolution and diversification of *Curcuma*. Two new species viz., *Curcuma fuscibracteata* sp. nov. and *Curcuma flavens* sp. nov. allied to *Curcuma mutabilis* with unique distinguishable characters such as plant height, leaf margin, lamina base, bracts colour, inflorescence length, tepal colour, rhizome are described from Southern Western Ghats of Kerala state.

*Curcuma*, Southern Western Ghats, Zingiberaceae

### **B-08**

#### **Isolation and characterization probiotic lactic acid bacteria of Cangkul, the traditional fermented food from Jambi, Indonesia**

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In this study, the isolation and characterization of four Lactic Acid Bacteria (LAB) were analyzed microscopically and biochemically. LAB isolates from Cangkul were called LAB-CK. The four isolates were bacilli and cocci Gram-positive, catalase-positive, and heterofermentative. All isolates of LAB-CK showed good resistance toward acid resistance test and bile salt tolerance. LAB-CK1 is the best probiotic candidate that has the highest viability value in low pH media with a percentage of 97.7%, and the percentage of viability LAB-CK1 in bile salts is 87.15%.

Also, LAB-CK1 showed good value of antimicrobial ability that has inhibition zone of 5.7mm against *Escherichia coli*, 2.5mm against *Listeria monocytogenes*, and 7.15mm against *Staphylococcus aureus*. The DNA from BAL-CK1 then will be isolated for molecular identification.

Antimicrobial ability, cangkuk, lactic acid bacteria, probiotic

### **B-09**

#### **Species composition of bird community in semi-urbanized area of Kuala Terengganu, Malaysia**

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The development from rural sector to be more urbanized is certainly affects the existence of the natural bird community in that area. This study aims to describe the composition of bird species in the developed semi-urban area of Kuala Terengganu, Malaysia. The 20 minutes search - a simple technique for bird counting was conducted to enlist the encountered bird species and to estimate bird presence rate in 13 stations with different characteristics of habitations. A total of 60 species of bird belong to 32 families was recorded during 8 months of observations. Around One of third (n: 18) of recorded species identified as fully or partially migratory species. Certain species are only found in limited area and fragmented vegetation, such as green iora (*Aegithina viridissima*) and accipitrid birds. Majority of recorded species is under least concern (LC) status, while only 1 species (javan mynah, *Acridotheres javanicus*) is identified as vulnerable (VU). About 10% (n: 7) recorded species belong to domesticated or introduced species that well adapted to urbanized environment, with three well-known invasive corvid species were identified (*Corvus enca*, *C. macrorhynchos*, and *C. splendens*). While majority of recorded species in this study is forests- and/or waterbodies-dependent bird, the unsustainable development of Kuala Terengganu city with regardless of green space could resulted in the loss of most of natural habitat-dependent bird, and might giving a chance to the invasive bird domination in the future.

Bird community, invasive bird species, migratory bird, semi-urban area

### **B-10**

#### **Diversity of Vesicular Arbuscular Mycorrhizal (VAM) based on age of the abandoned agricultural land in karst area, Central Buton, Southeast Sulawesi, Indonesia**

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Shifting farming systems causes abandoned agricultural land lead to succession. Plants tolerant of dry land and lacking nutrients initiate the succession and are generally in symbiosis with soil microorganisms, one of which is Vesicular Arbuscular Mycorrhizae (VAM). This study aims to determine the type and diversity of VAM on agricultural land in the Karst area of Central Buton in four different agricultural lands based on the duration of time left. Isolation of VAM spores using a combination method of wet pour and centrifugation. The similarity of spore characteristics based on the INVAM (International Culture Collection (Vesicular) Arbuscular Mycorrhizal Fungi) site. The characterization data were analyzed using numerical-phenetic analysis through the MVSP (Multivariate statistical package) program to see similarities and visualized with a dendrogram, then calculated the diversity index. The similarity with the reference species is 90-95%. VAM were found namely; *Acaulospora colombiana*, *Acaulospora foveata*, *Acaulospora mellea*, *Acaulospora morrowiae*, *Acaulospora denticulata*, *Acaulospora delicata*, *Glomus macrocarpum*, *Glomus clavisporum*, *Glomus mosseae*, *Glomus viscosum*, *Glomus hoi*, *Funneliformis geosporum*, *Funneliformis coronatum*, *Rhizophagus manihotis*, *Rhizophagus intraradices*, *Gigaspora margarita*, *Gigaspora decipiens*, *Paraglomus brasilianum*. The diversity of VAM species found in the Karst area of Central Buton on the four agricultural lands is in the medium category.

Diversity, karst region, Vesicular Arbuscular Mycorrhizal (VAM)

## **B-11**

### **Genetic distance and conservation status of stingray species at TPI Tasik Agung Rembang, Central Java, Indonesia, based on mitochondria Cytochrome Oxydase (CoI) Gene**

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Genetic distance and conservation status of stingray species at TPI Tasik Agung Rembang, Central Java based on mitochondria Cytochrome Oxydase (CoI) Gene. The purpose of this study was to examine the genetic distance and conservation status of five stingray species discovered in TPI (Fish Auction) Tasik Agung: *Himantura uarnacoides*, *Himantura walga*, *Himantura gerrardi*, *Rhinobatos penggali*, and *Brevitrygon heterura*. The data obtained are important as basic information data in the effort to preserve genetic diversity. Using the Polymerase

Chain Reaction (PCR) technique, the DNA barcode approach the Cytochrome oxidase I (CO1) gene was used to achieve the research objectives. The sequences were edited in Basic Local Alignment Search Tool (BLAST) program before being analyzed in MEGA 10 software for phylogenetic tree reconstruction and genetic distance. The genetic distance between the most closely related species is 0.002 between *Dasyatis zugei* and *Telatrygon zugei*, and the largest genetic distance is 0.231 between *Rhinobatos penggali* and *Brevitrygon heterura* with *Himantura walga*. The IUCN conservation status of stingrays observed during the study revealed four species in the vulnerable category (VU) and one species in the near threatened (NT).

Conservation, mtDNA CO1 gene, phylogenetic, stingray, TPI Tasik Agung

## **B-12**

### **Composition analysis of bird community feed types and guilds in tropical peat ecosystem (Case study: Buffer area of Orang Kayo Hitam Forest Park, Jambi, Indonesia)**

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Tropical peat ecosystems are very vulnerable to fire damage and conversion, including in the buffer villages around the OKH Tahura. On the other hand, the peat ecosystem is a habitat for various types of birds that ecologically act as seed dispersers, pest controllers, and pollinators so that their presence can be used as bioindicators of environmental quality. This study aims to analyze the composition and feed guilds of the bird community. The line transect method is used to explore the path in bird watching. The data were then analyzed descriptively and qualitatively. Found as many as 30 species from 18 families consisting of 9 species of waterbirds and 21 species of land birds. The families with the highest number of species were Alcedinidae and Columbidae with a percentage of 13.33% each (4 species), while the lowest were Apodidae, Bucerotidae, Hirundinidae, Laniidae, Meropidae, Psittacidae, Rallidae, Cisticolidae, Turnicidae, Ploceidae, and Passeridae with a percentage of 3.33% each (1 species). Based on the feed guild, there were 9 types of guilds with the highest percentage being granivore (26.67%), while the lowest was insectivore on the forest floor (3.33%). The presence of bird species based on the feed guild indicates that the land cover of the buffer village around the OKH Tahura is dominated by shrubs or weeds.

Bird composition, bird feeding guild, peat ecosystem

**B-13****Stingless bee diversity from melliponiculture, Central Java, Indonesia**

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Stingless Bee (Meliponiculture) cultivation in Indonesia continues to grow, including in Central Java, which is spread around the forest and outside the forest area. The purpose of this study was to find the diversity of cultivated stingless bee species, and stingless bee cultivation techniques that are suitable for conditions in Java. The method used is a survey method in the areas of Banyumas, Purbalingga, Banjarnegara, Wonosobo, and Kebumen. The results of the first phase of the research showed that in Banyumas and its surroundings 9 species were found, namely *Tetragonula laeviceps*, *T. drescheri*, *T. buroi*, *T. cypearis*, *T. fuscobalteata*, *T. minangkabau*, *Heterotrigona itama*, and *Geniotrigona thoracica*. The highest number of cultivated colonies was *T. laeviceps*, which was 2050 colonies. On average, farmers still use original nests (logs) either from wood or bamboo. The highest colony productivity was *H. itama* (600mL/3 months) and the lowest was *T. laeviceps* (60mL/3 months). The technology used by farmers is still traditional. The results of this study will be used as the basis for further research to determine suitable species both in terms of adaptation and honey productivity.

Cultivation techniques, logs, productivity, species, stingless bee

**B-14****Diversity of ectoparasit in Bawal (*Glassoma macropomum*) Cental Hatchery Bawal Rakit Banjarnegara, Central Java, Indonesia**

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Bawal fish is the largest fish of the neotropical fish class. Many are cultivated by the community because of easy feed with large fast growth. One of the obstacles to cultivation is the challenge of disease occurrence, such as parasitic diseases (ectoparasites). Research has been carried out which aims to determine the diversity of ectoparasites in bawal (*Colossoma macropomum*) at the bawal Hatchery Center Banjarnegara. The research method used is a survey method with a purposive random sampling technique. The variables observed were the prevalence and diversity of ectoparasites. The parameters observed were the type and number of ectoparasites found in bawal. The results showed that the prevalence of ectoparasites in bawal fish

was 23%. The types of ectoparasites found were *Dactylogyrus* sp. *Ichtyophthirius* sp. and *Iodine* sp. The ectoparasite diversity index is 0.43.

Bawal, *Collosoma macropomum*, diversity, ectoparasites, Rakit Banjarnegara

**B-15****Chemical ecology study: Antifeedant and ichthyotoxicity of crude extract from *Holothuria scabra***

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*Holothuria scabra* is a sea cucumber that use morphological and chemical defenses to protect themselves from predator. This study aims to describe the morphology of *H. scabra* from Lampung waters and to determine their chemical defense mechanism. The morphological identification of the collected specimens from Pesawaran beach, Lampung were performed by observing their body appearance, tentacles, weights and lengths. The observation of the ossicles was performed using a light microscope (LEICA ICC50 HD) at 400x magnification and a SEM (Jeol-JCM6000). The ethanolic extract of *H. scabra* was used for antifeedant and ichthyotoxicity assays using *Heros severus* and *Prionobrama filigera*, respectively. The total saponin content in the crude extract of *H. scabra* was determined by colorimetry using the vanillin-sulfuric acid test. The results showed that the lengths of the tested specimens were around 235-260 mm and their weights were approximately 407-579 g. All observed specimens displayed peltate tentacles surrounding their mouths. The shape of the ossicles consist of six to fourteen-hole buttons, tables, spiny perforated plates from the cloaca, tube foot rods, tentacle rods, dorsal rods, dorsal perforated spiny rods, I shaped and branched rods. The average natural concentration of tested specimens was 30.88 mg/mL with an average total saponin of 0.02±0.004 mg/mL. The antifeedant assay showed that 64.7% of *H. severus* deterred the pellet containing *H. scabra* extract. Meanwhile, the ichthyotoxicity test showed that extract containing 0.09 mg/mL of saponin killed *P. filigera*. Based on these results, we argue that the survival of *H. scabra* against predators depends not only on their chemical defense, but also on their thick body wall and cryptic behaviour.

Antifeedant, chemical defense, ichthyotoxicity, saponin, sea cucumber

**B-16****Diversity of non-volant small mammals in tropical peatland ecosystem Orang Kayo Hitam Forest Park, Jambi, Indonesia**

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Orang Kayo Hitam Forest Park (Tahura OKH) is an area dominated by peatlands. The largest forest fire in the Tahura OKH area occurred in 2015 and resulted in more than 70% of the area being damaged. This will affect biodiversity, especially small mammals. Small mammals have an important role in the ecosystem as agents in regeneration and restoration, including in the Tahura OKH ecosystem. This study aims to analyze the diversity of non-volant small mammals in Tahura OKH. The method used is the trap method which is placed by systematic sampling. Traps were placed in two types of habitat, namely shrubs and forests. The bait variations used consisted of coconut, sweet potato, banana, and oil palm fruit. All baits were treated by burning to give off an aroma. The resulting data were analyzed quantitatively using the Shannon-Wiener Diversity Index. Types of small mammals found in shrubs and forest habitats are scrub rats (*Rattus tiomanicus*) and coconut squirrels (*Callosciurus notatus*). The diversity index shows a low category with a value of  $H'$ : 0.519579. This indicates that the condition of the habitat in the post-burnt peat ecosystem is still relatively depressed.

Diversity, peatland, small mammals

**B-17****Composition and age class of long-tailed monkeys (*Macaca fascicularis*) in the tropical peat ecosystem (Case study in the Orang Kayo Hitam Buffer Forest Village, Jambi, Indonesia)**

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The long-tailed mcaque (*Macaca fascicularis*) has a fairly wide population distribution in Indonesia. According to IUCN data, the population of long-tailed mcaque is decreasing every year, the cause is a decrease in habitat quality. One of the habitats of long-tailed mcaque which is currently under pressure due to conversion is located in a buffer village around the Orang Kayo Hitam Forest Park (Tahura OKH). This study aims to analyze the composition and age class of long-tailed monkeys. Observation methods were used to observe long-tailed mcaque based on morphological characteristics such as coat color and body

size. Based on the results of the study, the composition of long-tailed mcaque was divided into two groups, the residential group (KP) and the river border group (KS). The number in KP is 32 individuals with an age class of 24 adults, 8 teenagers while the number in KS is 49 individuals with an age class of 33 adults, 10 teenagers, 4 children, 2 babies. This condition illustrates that the river border habitat is better than the residential habitat. In addition, adults and adolescents are more numerous, indicating individuals who have a function for reproduction and continue reproduction. This breeding rate is the potential for regeneration of long-tailed mcaque and the potential for the regeneration process of peat ecosystems through the role of long-tailed monkeys as pollinators for seed dispersal.

Composition, long-tailed macaque, peatlands

**Diversity of Ecosystem****C-01****Net primary productivity and community structure of plankton and benthos in different mangrove vegetation in Batukaras, Pangandaran, Indonesia**

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The ecological and economic importance of mangroves is highly recognized in West Java, especially after the 2006 Pangandaran Tsunami. Mangrove ecosystem of Batukaras were damaged and changed due to the 2006 tsunami. We analyzed the net primary productivity (NPP) with the community structure of phytoplankton and macrobenthos in the mangrove ecosystem (mangroves and nypa) after the recovery and restoration in different vegetation. The observation stations was determined by purposive sampling method based on the vegetation density. The obtained data are analyzed with the light and dark bottle (Winkler method), Shannon Wiener diversity index ( $H'$ ), evenness index ( $E$ ), and dominance index ( $D$ ). The results show that the primary productivity (NPP) in mangrove and nypa ecosystems is mesotrophic with values of 105.833 and 36.463 mgC/cm<sup>3</sup>/hour. The density of phytoplankton and benthos in mangroves is 560 ind/m<sup>3</sup> and 387 ind, while nypa ranges from 1140 ind/m<sup>3</sup> dan 135 ind. The community structure of phytoplankton and benthos mangroves was dominated by *Planktoniella* sp. and *Faunus ater*, while at the nypa location consisted of *Oscillatoria* sp. and *Terebralia sulcata*. NPP and community structure of phytoplankton and benthos communities in mangrove and nypa vegetation has significant differences (<0.05).



The mangrove ecosystem shows relatively stable and non-polluted waters.

Macrozoobenthos, mangrove, nypa, NPP, phytoplankton

## **C-02**

### **Community-mangrove-forest plantation's roles on carbon sequestration and stocks in Singkawang Utara District of West Kalimantan, Indonesia**

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Mangrove is a unique ecosystem located in coastal areas, where reciprocal relationships between biotic and abiotic components occur. Mangroves play a significant roles ecologically, physically, and economically, so serious efforts are needed to maintain their functions and benefits, including their essential function as carbon sinks and stores. One of the mangrove areas in West Kalimantan is the mangrove forest in Setapuk Besar Village, Singkawang City, covering an area of 20.68 hectares. This area is unique because of the local community's independent cultivation. This mangrove forest area is maintained because of public awareness to preserve mangrove forests by planting several species of mangroves, including *Rhizophora apiculata*, *Rhizophora mucronate*, and *Rhizophora stylosa*. The assessment results show that this area stores 114.09±4.39, 78.74±1.83, and 60.76±0.82 tons ha<sup>-1</sup> for 6, 5, and 4 years old plants. These mangroves can sequester carbon of 19.02, 15.75, and 15.18 tons ha<sup>-1</sup> year<sup>-1</sup>, respectively. The significant ability of this young mangrove area needs to be maintained.

Carbon sequestration, carbon stocks, community's efforts, planted- mangrove area

## **C-03**

### **Review: Seagrass ecosystems on supporting sustainable blue economy in Indonesia**

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The blue economy is a concept that seeks to achieve a balance between two related aspects of the marine ecosystem: ecology and economy. One of the activities that can contribute greatly to the blue economy is by increasing the absorption function of blue carbon in Indonesia's marine coastal areas, such as seagrass ecosystems. Intensifying the role of coastal and marine ecosystems, including seagrass, as blue carbon sinks to improve the

quality of Marine Protected Areas (MPA) up to 30% of all territorial water of Indonesia has been one of the government's efforts to accomplish Indonesian blue economy objectives. As one of the "big three" stores of blue carbon, seagrass can absorb and transfer large amounts of carbon and then deposit it for a long time. However, damage to seagrass meadows in Indonesia has occurred since 1960 with a decline rate of global seagrass meadows is approximately 2-5% per year. Given the crucial role of seagrass ecosystems, the number of research about restoration efforts on seagrass ecosystems increases along with the awareness of Indonesian seagrass importance in the sustainable blue economy.

Blue carbon, blue economy, seagrass

## **C-04**

### **Physicochemical characterizes of argan oil (*Argania spinosa* L.) affected by roasting and pulping by goats**

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Present study investigates the influence of roasting and pulping by goats on the quality of argan oil (*Argania spinosa* L.). To carry out this work, four different samples selected by their method of extraction (by mechanical pressing from argan fruits pulped by goats). The study of the physicochemical characteristics of the four samples shows that the roasting of the almonds of the argan fruit and the pulping by the goat appear as a parameter can increase the value of the peroxide index and the acidity. It's also found that pulping by goats can decrease the value of fatty acids (linoleic C18: 2) and the percentage of triglycerides (LLL, LOO and OOO) in argan oil. The result of sterols clearly shows that roasting is reduced the total sterols. The study of the concentration of benzo- $\alpha$ -pyrene suggests that roasting does not produce significant amounts of benzo- $\alpha$ -pyrene. Also, present findings show that roasting and pulping by goats appears as a parameter influencing the acid value of argan oil. In fact, the acidity value is higher in the argan oil samples prepared from roasted almonds and pulped by goats. Finally, the present study indicated that the high quality of argan oil can be extracted by mechanical pressing and which is not pulped by goats and, therefore, current results may support the marketing of the oil argan.

Argan oil, goats, method of extraction, physicochemical analysis, roasting

## **C-05**

### **Model based coral reef ecosystem states analysis in Gili Matra Marine Protected Area, Indonesia**

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The coral reef ecosystems' exploitation level in the Gili Matra Marine Protected Areas is relatively high. This condition will impact the damage to the coral reef ecosystem, which is one of the conservation targets in the area. The rate of utilization and degradation of conditions is faster than the time for corals to recover. Coral reef ecosystems are complex coastal ecosystems, so it is necessary to assess conditions that can describe current conditions and predict future conditions to reduce the rate of degradation. Therefore, this study tries to use Emergy analysis to assess the condition of coral reef ecosystems in the Gili Matra Island Conservation Area, which can provide an overview of current conditions and predict future conditions using models and simulations. The results show that the condition of the coral reef ecosystem in the core zone, utilization zone, and fisheries zone has improved. Coral reef ecosystems in the core zone are more resistant than other zones. The simulation results show that living hard corals as storage in the utilization zone recover faster than in the fishery zone. With the same parameter conditions and no management action, the area of live hard coral cover will continue to decline until it reaches zero in the 200th year in the utilization zone and the 143rd year in the fisheries zone. Reducing the number of destructive utilization activities is more effective than adding Emergy input from zooxanthellae, megabenthos, or reef fish, either in the form of transplantation or fishing restrictions, as an effort to reduce the rate of degradation.

Coral reef ecosystem, emergy, emergy analysis, Gili Matra Marine Protected Area, model-based state analysis

**C-06****Threat of charcoal processing to tree species in Otemewo Community, Okpe, Delta State, Nigeria**

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The status of tree species used for charcoal processing and its effect on tree diversity in Otemewo community, Okpe, were assessed. Semi-structured questionnaire guide and random sampling technique were used to collect data on the trees species. Besides five points likert rating scale on species preference for charcoal, and paired t-test were used to determine the implication of tree species preference for charcoal production on diversity. A major charcoal processing site was selected for the study. Also samplings were done in two randomly selected sample plots. Twenty-eight (28) tree species belonging to 13 different families were cited as trees preferred for charcoal processing.

Meanwhile, only ten (10) species: *B. cogolensis*, *E. cylindricum*, *I. gabonensis*, *K. senegalensis*, *L. alata*, *L. lanceolata*, *P. africana*, *P. macrophylla*, *T. orientalis* and *U. guineensis* of the twenty-eight (28) trees recorded as charcoal-producing species existed in the two sample plots, and were comparatively rare. Diversity indices reveal that one of the two randomly selected plots was richer in tree species than the other. Consequently, it was suggested that high rate of deforestation and unsustainable collection pattern of trees for charcoal threatens the forest ecosystem and negatively affected the diversity of tree species in the area. Therefore, strategies that would ensure tree species management and by extension the entire forest ecosystem in the Community were suggested.

Charcoal, Otemewo community, species preference, tree diversity

**C-07****Agronomic characteristics of sago (*Metroxylon sagu*) at various harvest time as a determinant of sago starch yield**

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Smallholder sago plantation is generally used simple technology so that the determination of harvest time is only based on the physical appearance of plants. This study determines the agronomic characteristics of sago that affect starch yield. The research was conducted on smallholder sago plantations by determining samples of sago plants at four phases of harvest based on local customs: *Dewasa*, *Jantung*, *Rusa*, and *Bunga*. Observations on agronomic characteristics were no. of suckers, plant height, pith diameter, no. of leaves, leaf scars, leaflets, leaflet length, and leaflet width. ANOVA and multiple comparisons were used to determine the differences between treatments on starch yield. The regression analysis determines the relationship between starch yield and agronomic characteristics. Path analysis determines agronomic characteristics' direct/indirect effect on starch yield. The results revealed that the best harvest time is in *Jantung* and *Rusa* phases. The agronomic components that determine the starch yield of sago are pith diameter and leaf scars. The model that can explain the production is  $Y = -63.26 + 2.44x$  ( $R^2=37\%$ ). Efforts to increase starch yield need to improve the plant's spacing. Plant spacing is too close with a population density of more than 200 clumps/ha, causing overlapping leaves that negatively impact the formation of sago starch. The negative effect increases as the number of leaves increases and the length and width of the leaflets increase.

Agronomic characteristics, harvest time, path analysis

**C-08****Biodiversity and vegetation attributes of non-contiguous mangrove forests differentiated by location and zonation features in Oriental Mindoro, Philippines**

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Mangrove assessment was performed to determine the biodiversity, vegetation metrics, and importance values in the northern landscape of Oriental Mindoro, Philippines. A total of 108 quadrats (10m x 10m dimension) were purposively installed in four mangrove zonations across seven sampling locations. Species accumulation curve indicates a highly adequate sampling effort. The 26 identified mangrove species belonging to 13 different plant families. Shannon diversity value (2.58), species richness (25), and evenness (0.53) indicate high mangrove biodiversity metrics. The Highest Shannon diversity index is noted in Pola (2.71) and in the landward zone (2.73). Vegetation metrics in all locations showed mean tree height is 9 meters; mean DBH is 17.44 cm, the mean crown cover is 2.17 meters, mean biomass production is 212.49 tons/ha, and mean tree volume value is 0.1651 m<sup>3</sup>. The locations in Puerto Galera and San Teodoro have high values in tree height, DBH, biomass production, and tree volume. Middleward zonation has tallest tree height suggesting light competition in the middle zones. The computed species importance values are high in *Sonneratia alba* (95.25%), *Avicennia alba* (46.68%) and *Rhizophora apiculata* (33.75%). Computed mangrove metrics differ across sampling locations and zonations, which should be considered in conducting rehabilitation and conservation actions in the area.

Accumulation curve, biomass, importance values, Shannon diversity, zonation

**C-09****Microclimatic factors and soil characteristics of Arroceros forest park in the City of Manila, Philippines**

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Microclimatic factors affect many ecosystem functions. The challenge of acquiring consistent data has impeded the

quantitative assessment of the spatial heterogeneity of soil-climate in Arroceros Forest Park as a man-made urban forest park known as the last lung of the City of Manila. With this unassisted urban forest park, this study aims to determine the microclimatic factors such as light intensity, air temperature, air humidity, wind speed and direction, soil temperature, soil pH, percent organic matter, percent soil moisture and soil texture by using sieve analysis and textural triangle method to know the status of the forest park. These procedures reveal soil type available in the park to be clay and loam suitable for the plants to grow abundantly. Results showed that four microclimate factors viz. air temperature, air humidity, percent organic matter, and soil texture were highly significant ( $p < 0.000$ ). Additionally, it further revealed that microclimatic factors such as light intensity, wind speed, and soil pH to be significant microclimatic factors in an ecosystem. It also found that soil size is a significant parameter for soil characterizations in this kind of study. Finally, the division of soil microsites into different positions based on prevailing light or shade conditions was helpful in assessing the significant variations of soil characteristics and conditions within the study area.

Dynamics, sieve analysis, soil, textural triangle, urban ecosystem

**C-10****Trophic state index and carrying capacity estimation in Jatigede Reservoir, West Java, Indonesia**

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Aquaculture activities with floating net cages (KJA) are essential to increase fishery production. The existence of the KJA in the Jatigede Reservoir is illegal because it is against local regulations. However, the people affected by the dam construction still maintain it for economic reasons. Therefore, it is necessary to research to overcome these problems by determining the carrying capacity of aquaculture using the (Beveridge 1984) method by calculating the remaining phosphorus still available in the Jatigede Reservoir and evaluate the trophic state index based on three indicators: total phosphorus, transparency, and chlorophyll-a. The sampling method was carried out by purposive sampling. The calculation results show that the condition of the Jatigede Reservoir is eutrophic with a trophic state index (TSI) value of 60-69. The fish farming production in the Jatigede Reservoir is 14,932 tons of fish/per year. At the same time, the carrying capacity of the

reservoir is 1,084.69 tons of fish/per year, so it is necessary to reduce the total production of 13,848.11 tons of fish/per year. Based on the amount of fish production that has exceeded its current carrying capacity, fish production must be reduced according to the reservoir's carrying capacity so that the reservoir's sustainability is maintained.

Cage aquaculture, carrying capacity, reservoir, TSI

### **C-11**

#### **Abundance of Arbuscular mycorrhizal fungi in the rhizosphere of healthy and unhealthy citrus in East Nusa Tenggara, Indonesia**

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Citrus, one of the economic horticultural species in South Central East, East Nusa Tenggara, Indonesia, is experiencing a decrease in health due to some predisposing factors. Citrus is heavily dependent on Arbuscular Mycorrhizal Fungi (AMF) for its health, however, it remains understudied. This study was undertaken to investigate the abundance of AMF in the rhizosphere of healthy and unhealthy plants located at twelve geographical locations of citrus orchards. In each orchard, six soil and root samples representing three healthy and three unhealthy trees were collected. The soil collected was analyzed for AMF spore abundance and for physical and chemical properties while the roots were analyzed for AMF colonization. Data were analyzed using a nested design where the health condition of the trees was nested under the geographical location factor. The results showed that the abundance of AMF spore was significantly affected by the geographical location where the soils were collected but not by the health condition of the plant. Root colonization of AMF was affected by both geographical location and the health condition of the plant. Future studies need to be undertaken to screen the potential indigenous AMF for supporting the growth of citrus, particularly at the seedling stage before being transferred to the field.

Arbuscular mycorrhizal fungi, Citrus, healthy tree, unhealthy tree

### **C-12**

#### **Primary productivity in Ketugar Island, Bangka Tengah, Indonesia**

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Ocean primary production is an important factor for determining the ocean's role in the global carbon cycle. Primary production is the process whereby inorganic carbon is fixed in the sunlit (euphotic) zone of the upper ocean and forms the base of the marine food pyramid. It occurs when marine phytoplankton use sunlight energy and dissolved nutrients to convert inorganic carbon to organic material, thereby releasing oxygen. The objective of this study was to analyze primary productivity in Ketugar Island, Bangka Tengah, Indonesia. The study area was carried out in the seawater surrounding Ketugar Island, Bangka Tengah, Indonesia. The physicochemical sea water parameters were recorded for all stations. The area was divided into four research stations. Based on the data, the value of GPP was between 223.96 mg/L - 307.29 mg/L, NPP between 36.46-218.75 mg/L, R between 88.54-234.36 mg/L. In general, the mean value of temperature, pH, salinity, seawater current, and brightness were  $28.5 \pm 0.5^\circ\text{C}$ ;  $5.75 \pm 0.83$ ;  $15 \pm 12.74$  ppm;  $0.076 \pm 0.032$  m/second; and  $0.21 \pm 0.15$  m. GPP rates are still in the typical state range for the seawater of the equator. Based on data, the sampling area was oligotrophic - eutrophic, since it has different value of NPP.

Marine waters, photosynthesis, phytoplankton, primary productivity

### **C-13**

#### **Taxonomic and functional diversity of aquatic macroinvertebrates from natural and least disturbed forests as references for regional stream health indicator**

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Using aquatic animals such as macroinvertebrates as a biomonitoring method has been applied in various countries. However, using macroinvertebrate-based ecological indicators such as taxa richness, abundance, diversity, composition, and biotic index requires calibration to be local or regional geographic conditions. This study aims to build a database of aquatic macroinvertebrate indicators as a reference for assessing stream health at a local or regional scale. Seven streams of the first and second order in the natural and slightly disturbed forest were selected from three main watersheds in Southeast

Sulawesi: five points in the Lasolo watershed and one point each in the Wanggu watershed and the Laeya watershed. A sampling of macroinvertebrates from various microhabitats in each stream segment with a length between 100-150 meters using a D-frame and Surber net. Water physicochemical parameters were measured directly in the field and laboratory. Sampling was conducted from August to September 2021 and February to March 2022. The results showed 2,771 individuals belonging to 93 taxa (genus), 60 families, and 19 orders collected at all stations. The order with the highest percentage was Decapoda (21.3%), followed by Odonata (13.7%), Ephemeroptera (12.30%), and Trichoptera (11.9%). The remaining 10% consists of Isopoda, Hemiptera, Diptera, and Blattodea. The proportion of macroinvertebrate functional groups from highest to lowest was shredders (38%), predators (25.8%), scrapers (20.5%), filtering-collectors (10.2%), gathering-collectors and collectors (0.2%). The Shannon index of the seven streams ranges from 2.22 - 3.06. Tests with the Biological Monitoring Working Party (BMWP) index generally categorize streams at a moderate level. This study provides essential information about the taxonomic richness and functional groups of macroinvertebrates for the identification and management of stressed streams.

Lasolo, macroinvertebrates, natural forest, stream health

## C-14

### Biodiversity of microscopic fungi in ex-coal mining soil on maize and sengon growth due to arbuscular mycoriza fungi

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Ex-mining land must be reused as land that can be planted. Reclamation process is needed. The use of Arbuscular Mycorrhizal Fungi (AMF) is needed as an alternative that can be used as biological fertilizer to restore ex-mining land. However, the presence of other fungi in the soil can act detrimentally, namely causing plant diseases. Information on the presence of soil-borne pathogens will be very useful as a basis for determining appropriate and efficient reclamation management strategies. For this reason, this preliminary research was conducted. This study aims to identify the types of microscopic fungi isolated from ex-coal mining soil and to determine the effect of AMF inoculum on maize growth and also experiments on sengon with AMF treatment with the addition of compost to the soil. Samples were taken from a coal mine site in Kapuas, Central Kalimantan, Indonesia, which represents the mining area (pit) and watershed at different depths. As supporting data, pH analysis was performed on each sample. Fungal isolation was carried out by serial dilution

method. Morphological characters were used for identification. The results of the analysis showed that the pH of the soil samples ranged from 4-6. A total of 31 isolates of mold were isolated from 11 soil samples. The isolates belonging to four genera, namely *Aspergillus*, *Penicillium*, *Trichoderma*, and *Curvularia* which are not soil-borne pathogens. The next stage is the study of AMF inoculation on maize and sengon on ex-mining soil, maintenance, and calculation of growth parameters (measurement of height, number of leaves, dry weight, and percentage of infection degree). The results showed that the AMF dose treatment on the ex-coal mining land had a good effect on the growth of maize and sengon. The height of maize at 8 weeks after planting at doses of 0, 100, 150, 200 AMF / 5 kg of ex-mined soil was 28.16, 101.25, 142, 139.5 cm, while the number of leaves was 3.33, 4.5, 5, 6 pieces. AMF with the addition of compost was effective in increasing the growth of sengon, as well as root dry weight, increase in plant stem diameter, number of leaves, wet weight of the plant, and dry weight of the plant.

Arbuscular mycorrhizal fungi, compost, ex-coal mining soil, growth, microscopic fungi

## Ethnobiology & Socioeconomics

### D-01

#### Sula Ethnic local wisdom in the conservation of forest honey bees (*Apis dorsata*) at Indonesia

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Honey bee provides significant health beneficial effects to society. For instance, it acts as a source of food, supplement for medicine production, and other various other purposes by variety of ethnic groups globally. However, inadequate sustainable conservation processes, such as deforestation and degradation, caused by overexploitation, logging, and conversion to other land uses, lead to declines in bee species populations. Several studies have investigated the role of local communities in utilizing honey from forest bees in Indonesia. However, none have reported its use by the Sula Ethnic group in the Sula Islands, North Maluku Province, Indonesia. Therefore, this research aims to analyze the Sula Ethnic group's local wisdom in the Sulawesi Islands of North Maluku in conserving forest honey bees. Data were randomly collected from village farmers living on the forest's edge through observation, semi-structured interviews, and household surveys. The obtained data were systematically analyzed and presented in tables and figures, using the thematic analysis. The results showed that the community has Mak maked li local wisdom in protecting the forest

beehive and the post-harvest tree. Furthermore, the result also showed that honey is a stamina booster (100%), relieves coughs (92.68%), sweetens food (87.80%), used as ingredients (85.37%), relieves ulcer (78.5%), colds (70.73%) and used to treat diarrhea in children and adults (58.54%), thereby making a natural product with the highest health benefits.

Conservation, forest honey bees, local wisdom, Sula Ethnic

## D-02

### Ethnobotany of hiking basecamp as a basis for eco-tourism attraction planning in mountain area

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Basecamp has a very crucial role in mountaineering as the initial entry point for ecotourism activities. In addition to providing information about hiking, basecamp should be used as a tourist attraction that can grow and increase the environmental awareness of the climbers. This research was an ethnobotanical study of the knowledge and use of land and home garden around the hiking basecamp for plant diversity by the people of Purwosari Village, Sukorejo Sub-district, Kendal District, Central Java, Indonesia. In this village, there is a conservation route for hiking to Mount Prau. Data was collected through semi-structured interviews. Interviews were conducted with informants selected by purposive sampling including village officials, community leaders, mountain prahu caretakers, and basecamp managers. The results showed four main groups of land use: yards, fields (vegetables and horticulture), gardens (wooden plants), and roads (corridors). The results showed that there were 68 species of plants known by the informants and used by the community. These plants are mostly used as a source of food, medicinal ingredients, and economic value. Meanwhile, other uses are for fodder, building materials, shade, and conservation plants. If this community knowledge is combined with the management of biodiversity planted in the yard of basecamp, it will have the potential as a tourist attraction. It is also necessary to add media information related to the species, uses, and conservation status of plants in the basecamp area. Thus this media is expected to be able to attract the attention of climbers and increase knowledge about the preservation of biodiversity and the environment.

Eco-tourism, environmental awareness, ethnobotany, plant conservation

## D-03

### Mangrove medicinal plants in Kutai National Park, East Kalimantan, Indonesia

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Mangroves are spread throughout the world, including Indonesia, which is one of the countries with the largest mangrove forests in the world. Indonesia has the highest level of mangrove diversity in the world, and Kutai National Park (Indonesia) mangrove is one of them. Those species of mangroves can be used for fuel, food, and medicine. This study aims to determine the species of mangrove plants that are used as medicinal products by the local community around the Kutai National Park and mangrove plants that can be used as medicine. The study was conducted in June 2020, using the roaming method in the form of observations or field observations in the mangrove area of Kutai National Park, East Kalimantan Province, Indonesia. Based on the research, there were 5 species of mangrove plants found that are used as medicinal plants by the community around the Kutai National park, they are *Acanthus ilicifolius* Linn., *Hibiscus tiliaceus*, *Passiflora foetida*, *Terminalia cattapa*, and *Xylocarpus granatum* that can be used to smooth lymph, cure types of goiter, spleen, cancer, hepatitis, stomach pain, asthma. There are also ten species of mangrove found in Kutai National Park Mangrove that can be used as medicine refers to journals and articles.

Community, Kutai National Park, mangrove, medicine, species

## D-04

### Ethnopharmacological evaluation of selected medicinal plants from East Kalimantan, Indonesia for diabetes therapy

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Type-2 diabetes is a metabolic disorder characterized by chronic hyperglycemia associated with complete or partial deficiencies insulin secretion. The development of the risk of type 2 diabetes may partially mediate the initiation of its complications such as neuropathy, nephropathy and retinopathy. Inspired by ethnopharmacological use and promising  $\alpha$ -glucosidase and radical scavenging activities, an attempt to investigate the ethnomedicinal plants was carried out. Twenty ethnomedicinal plant extracts from East Kalimantan (Indonesia) flora, traditionally used to treat blood sugar levels and other diabetes-related diseases, were examined in vitro for their antidiabetic and free radical scavenging activities by inhibiting rat  $\alpha$ -glucosidase and several free radicals such as DPPH, ABTS, and nitric oxide, respectively. The results showed that *Garcinia riedeliana*, *Shorea laevis*, *Pternandra azurea*, *Bridelia tomentosa*, *Garcinia nervosa*, *Syzygium caudatilimum*, and *Shorea balangeran* extracts exhibited strongest inhibitory activity with an IC50 values have a comparable with quercetin as natural inhibitor. Moreover, the antioxidant test showed that the twenty methanol extracts of ethnomedicinal plants from East Kalimantan have an antioxidant activity indicated by IC50 values. The present study is the first to confirms that the ethnopharmacological use of selected medicinal plants from East Kalimantan might have potential as an antidiabetic and natural antioxidant.

Diabetes, East Kalimantan, ethnopharmacology, free radicals, medicinal plants

### **D-05**

#### **Ethnobotany study of medicinal plants of the Dayak communities in North Kalimantan, Indonesia**

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This study of ethnobotany examines the traditional use of the medicinal plants used by the two Dayak communities (Kenyah Leppo' Ke in Apau Ping in Malinau and Lundayeh Wa' Yagung in Nunukan) in North Kalimantan Province, Indonesia. The medicinal plants collected during fieldwork were identified to 47 taxa comprised of 44 genera and 32 families in Apau Ping, and 84 taxa of 77 genera and 54 families in Wa' Yagung. They were recorded in the field by local names, traditional uses, preparations, plant part used, habitat and distance in radius from the village. Out of those medicinal plants, they used to treat physical ailments, personal care, and veterinary uses. Hence, mostly treated were wounds and skin, respiratory, reproductive, and digestive systems. One species may treat more than one ailment, and has other uses for agricultural, cultural, firewood, food, food preservation, food wrap, goods, hut, personal care, veterinary, and wood. Most numbers of medicine found in Zingiberaceae family

and herb life form. There were outstanding species as antidotes of venom or poisoning, which found in furthest habitat from the village. Communities depend on the shaman's knowledge and practice to be able to use some complicated medicine.

Dayak, ethnobotany, medicine, Kalimantan

### **D-06**

#### **Phytochemical screening, antimicrobial, antioxidant and catechin analysis of green tea from North Sumatera, Indonesia**

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Green tea has an unique and distinctive taste, this is influenced by geographical location, leaf age, type of picking and varieties, and clones. In this study, the researchers carried out phytochemical screening as a qualitative test, antimicrobial tests using the disc method with distilled water as a negative control, antioxidant test using DPPH method with visible spectrophotometer, and catechin content using High Performance Liquid Chromatography (HPLC) method. From this study, it was found the green tea was positive for flavonoids and tannins also terpenoids. For antibacterial test against pathogenic bacteria *Staphylococcus aureus*, *Streptococcus mutans*, and *Salmonella typhi* provided good inhibition zones, for the test antioxidant using Spectrophotometer visible obtained IC 50 of 33,33 which states a very strong antioxidant and catechin content test using HPLC obtained 16.9%.

Antimicrobial, antioxidant, catechin, green tea, phytochemical screening

### **D-07**

#### **Seed extracts of seven mango cultivars (*Mangifera indica*) in Indonesia: Evaluation of antibacterial activity against Methicillin-Resistant *Staphylococcus aureus* (MRSA) causing wound infections**

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MRSA is a Gram-Positive bacterium resistant to  $\beta$ -lactam and penicillin antibiotics, including methicillin, oxacillin, and cephalosporins mostly found in wounds. Seed extracts of seven Indonesian mango cultivars have been demonstrated to possess antibacterial efficacy against MDR *P. aeruginosa* (Gram-Negative bacteria). To minimize the gap, this study examined the antibacterial activity of seed extracts of seven mango cultivars (*Mangifera indica* L.) in Indonesia against Methicillin-Resistant *Staphylococcus aureus* (MRSA) isolated from wounds. The antibacterial activity was tested using an agar well diffusion method to measure the diameter of the inhibition zone and a microdilution method to obtain the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) values. Seed extracts of seven mango cultivars exhibited antibacterial activity against four MRSA bacteria isolated from wounds. With MIC and MBC values of 1.56 mg/mL and 6.25 mg/mL, respectively, seed extracts of seven mango cultivars acquired the highest inhibition zone diameters, ranging from 8 mm to 20 mm. In conclusion, seed extracts of seven mango cultivars can be developed as an antibacterial agent, particularly against MRSA strains causing wound infections.

Antibacterial activity, *Mangifera indica*, MRSA, wound

## Bioscience

### E-01

#### Antagonistic activity of fungal endophytes isolated from *Santalum album*

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Endophytic fungi play an essential role in physiological and ecological symbiosis with plants, protecting plants from pathogens and an unfavorable environment by producing secondary metabolites. This study aims to determine the antagonism of endophytic fungi isolated from the sandalwood plant's root, stem, and leaf against three phytopathogens in vitro. Endophytic fungi were isolated by a direct plating method, then purified and identified. All endophytic fungi obtained were tested for

their antagonistic ability against *Alternaria* sp., *Fusarium* sp., and *Phytophthora palmivora* in vitro by dual culture. The percentage of inhibition was analyzed using analysis of variance and continued with the 5% DMRT test. From the study results, 141 endophytic fungal isolates were successfully isolated from the sandalwood plant's roots, stems, and leaves. Twenty-nine isolates of endophytic fungi were obtained from the roots, 33 isolates of endophytic fungi were obtained from the stems, and 34 isolates of endophytic fungi were obtained from the leaves. All isolates of endophytic fungi obtained were able to inhibit the growth of *Alternaria* sp., *Fusarium* sp., and *P. palmivora* in vitro, with various inhibition percentages ranging from 26.7 to 83.3%. Further research will focus on secondary metabolites produced by selected endophytic fungal isolates, which can inhibit phytopathogens above 70%.

Antagonistic activity, cendana, endophytic fungi, *Santalum album*

### E-02

#### Mycorrhization of *Dendrobium* hybrid during acclimatization using fungal isolate from *Paphiopedilum* orchid

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Orchid mycorrhiza is the symbiotic association between orchid and their fungal partners. This association is found along the orchid's life cycle for seed germination, seedling establishment, and vegetative growth and development. The fungal symbionts provide their host with nutrients and water for photosynthate as a reward. The association suggests more generalist since a single fungus can partner with multiple orchids and vice versa. Taking benefit of the type of specificity, we isolate *Rhizoctonia*-like fungi from *Paphiopedilum javanicum* and conduct mycorrhization to *Dendrobium* plantlets. The result indicated an increase in the growth and survival rate of the inoculated-plantlet during acclimatization.

*Dendrobium*, mycorrhiza, orchid, *Paphiopedilum*, *Rhizoctonia*

### E-03

#### Embryo and larvae development of nilem fish (*Osteochilus vittatus*) reared in batik liquid waste

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The embryonic and larval stages are critical phases of organism's development. For aquatic organism, development is affected by environmental factors such as liquid waste. A batik liquid waste is a waste product of the textile industry usually streamed directly into the aquatic environment. This study aimed to observe the exposure of batik liquid waste effects on development of Nilem (*Osteochilus vittatus*) fish embryos and larvae. The research was conducted using completely randomized design. One hundred of two-cells embryos were kept in batik liquid waste with dilution concentrations of 0% (control), 5%, 10%, 15%, and 20% of water until the age of 4 days after hatching with 5 replications. The time of embryos evaluation were 60th minute, 120th minute, and 180th minute after fertilization and the larval stage evaluation time were 24th, 48th, 72th, and 96th hour after fertilization. Five embryos were evaluated for each replication. The results showed that embryos exposure to batik liquid waste affected the height of the blastoderm embryo, accumulation of waste in the chorion of the embryo, deceleration of embryonic development, increased larval abnormalities, decreased the survival rate of larvae, and acceleration of yolk absorption of fish larvae. Embryos were successfully hatched and produced larvae only in control and 5% batik liquid waste medium.

Batik, embryogenesis, *Osteochilus vittatus*, waste

#### **E-04**

##### **Antioxidant and anti acne of propolis of stingless bee (*Tetragonula biroi*) from Balikpapan, Indonesia**

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Exploration bioactivity of propolis, especially from Stingless bee are still limited. *Tetragonula biroi* is one of Stingless bee species. The products of this bee are honey, propolis and bee pollen. In this study, we searched the natural product that can be used as cosmetic ingredient. We examined the phytochemicals, antioxidants (DPPH method) and anti acne (agar diffusion method) with *P. acnes* on this propolis extract. The results of displayed this extract contained various phytochemicals; has antioxidant activity in several concentration; and inhibited anti acne in various concentration of samples. Based on the fractionation and separation with chromatographic (column chromatography and MPLC/Medium Pressure

Liquid Chromatography) several compounds potential to be isolated.

Anti-acne, antioxidant, phytochemicals, propolis, *Tetragonula biroi*

#### **E-05**

##### **Existence and characterization of potential acid fermentative bacteria from fresh sago pith (*Metroxylon sagu*)**

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Sago is one of the largest agricultural commodities in West Sumatra. The presence of organic matter content of starch and fiber found in sago pith is considered source of fermentative indigenous bacteria. The study was to conducted in order to perform the existence of indigenous fermentative bacteria, determine the characterization and character of the potential acid fermentative isolate as a lactic acid bacteria. This research was conducted by survey method and analysis descriptively. The result showed that the presence of acid fermentative bacteria in sago pith (56 x 105 cfu/g). Isolate SG06 has higher potential index of fermentative selected as a potential indigenous acid fermentative bacteria.

Acid fermentative, characterization, indigenous, lactic acid bacteria, sago pith

#### **E-06**

##### **Bacterial isolates from blowflies (*Chrysomya megacephala*): Antibacterial potential against multidrug-resistant bacteria**

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The high number of infections caused by bacteria resistant to several groups of antibiotics (Multidrug-Resistant Bacteria (MDR)) has become a serious health problem in developing countries, including Indonesia. Natural antibacterial agents are needed to overcome these infections. It has been reported that on the body surface of flies, there are bacteria that have the potential as antibacterial agents, but the antibacterial potential of bacteria in the body of flies as antibacterial agents against MDR bacteria has never been reported. To address the research gap, this study aimed to evaluate the potential of the associated bacteria in the bodies of flies as an antibacterial agent against MDR bacteria. The study was conducted by isolating and identifying bacteria from the body of the blowfly (*Chrysomya megacephala*), and then antibacterial activity tests against MDR bacteria were carried out using the agar well diffusion assay method. The

results showed 16 isolates of bacteria from *C. megacephala* bodies. The antibacterial tests revealed that bacterial isolates of *C. megacephala* had antibacterial activity against carbapenemase-resistant *Klebsiella pneumoniae* (CRKP), carbapenemase-resistant *Pseudomonas aeruginosa* (CRPA), and vancomycin-resistance *Enterococcus* (VRE). Meanwhile, in the extended spectrum of beta-lactamase *Escherichia coli* (ESBL-*E. coli*) and Methicillin-resistant *Staphylococcus aureus* (MRSA), the bacterial isolates of blowfly bacteria did not produce antibacterial activity. Bacterial isolates that produced antibacterial activity were L2C, L2D, L3D, L3G, L3H, L4A, and L4C. These results provide information about the potential of *C. megacephala* bacteria as a natural antibacterial source against MDR bacteria.

Antibiotics, blowflies, MDR bacteria

### **E-07**

#### **Interspecific interactions between the Javan gibbons (*Hylobates moloch*) with other primates in Bodogol Reserve, Mount Gede Pangrango National Park, Indonesia**

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The interactions that occur between different species are called interspecific interactions. Javan gibbons, Surilis, Javan langurs, and long-tailed macaques have almost the same way of life, namely diurnal, and arboreal, and have almost the same preferences for food trees so the potential for interspecific interactions is high. Interspecific interactions have a great influence on the existence of populations in a community, including the Javan gibbon population in its community. The purpose of this study was to determine the types of interspecific interactions and to determine the possibility of niche overlap based on the choice of feed between the Javan gibbon and other primates in the Bodogol Reserve, Indonesia. Data about Javan gibbon's behavior was collected using the focal sampling method and data from other primates' surveys were collected using the exploratory method. Interspecific interactions were observed using the ad libitum method. Interspecific interaction data were analyzed descriptively referring to the characteristics of interspecific interactions. The possibility of niche overlap based on feed selection was analyzed by calculating the Horn index. During the observation, interspecific interactions were found which were neutral in the form of cohabitation and negative in the form of agonistic behavior or attacking each other. The results showed that the largest niche overlap based on the choice of feed occurred between Javan gibbons and Javan langurs (Ro = 0.744).

Cohabitation, dietary niche, interspecific interaction, Javan gibbon

### **E-08**

#### **Existence of mud crabs (*Scylla* sp.) in anthropogenic affected mangrove communities in Andai Estuary, Manokwari, West Papua, Indonesia**

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Land clearing is often the main cause of changing coastal characteristics in an area. This condition has a direct impact on various coastal ecosystems, one of which is mangroves, which in the end more specifically become a negative limiting factor for many biota that live in them. For example, it affects the wealth, abundance, and distribution patterns of mud crabs. This study aims to determine habitat characteristics (mangrove habitat density, water quality and substrate and texture), community structure of the mud crab, and to analyze the relationship between habitat characteristics and the community structure of the mud crab. Method used is a survey method with purposive sampling technique. The site is divided into three stations with each station having 5 transects. Data on tree density, saplings and seedlings were carried out on 10x10 m<sup>2</sup>, 5x5 m<sup>2</sup> and 1x1 m<sup>2</sup> transects; while data on water and substrate quality were carried out simultaneously with mud crab sampling on a 10x10 m<sup>2</sup> transect. Existence of tree category mangroves played an important role in supporting the abundance of mud crabs, followed by the sapling and seedling categories. Principal Component Analysis explained that in particular, the parameter that most correlated with *S. tranquebarica* and became a limitation for its movement was the depth of the waters, while the parameter most correlated with *S. serrata* was the salinity of the waters. High anthropogenic pressure in the terrestrial area (upper land) affects the carrying capacity of mangrove forests as habitat for mud crabs. This condition occurs due to increased sedimentation (decreasing Clay substrate) which causes changes in water parameters as indicated by the decline in mangrove density (especially trees) and water depth.

Mangrove, mud crab, *Scylla*, *S. serrata*, *S. tranquebarica*

### **E-09**

#### **In vitro evaluation of antibacterial activity of seed kernel extracts of seven mangoes (*Mangifera indica* L) cultivars native to Indonesia against**

## MDR-*Pseudomonas aeruginosa* isolated from wounds

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*Pseudomonas aeruginosa* is the most common bacterium causing wound infections. The most common solution for infected wounds is to use antibiotics. However, excessive and inappropriate use of antibiotics will lead to the presence of multi-drug resistant (MDR) bacteria strains. Therefore, natural ingredients are needed as alternative antibacterial agents. This study aimed to determine the antibacterial activity of seed kernel extracts from seven cultivars of *Mangifera indica* from Indonesia (*Cengkir*, *Kopyor*, *Golek*, *Kweni*, *Avocado*, *Arumanis*, and *Manalagi*) against MDR-*P. aeruginosa* bacteria isolated from wounds. This study applied the agar well diffusion method to determine the inhibition zone and the microdilution method to determine the MIC and MBC values. The results showed that the seed kernel extracts of seven cultivars of mangoes had antibacterial activity against MDR-*P. aeruginosa*. Of the seven mango cultivars, *Kweni* cultivar seed kernel extracts demonstrated the lowest MIC and MBC values of  $\geq 0.75$  mg/mL and  $\geq 12.5$  mg/mL. This study concludes that *Kweni* cultivar seed kernel extracts have the potential to be developed as agents of anti-MDR-*P. aeruginosa* causing wound infection.

*Mangifera indica*, MDR, *Pseudomonas aeruginosa*, seeds, wounds

## E-10

### Antibacterial activity of the fruit extracts of three mangrove species from the Sonneratiaceae Family against Multidrug-Resistant (MDR) isolates from clinical specimens

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Multidrug-resistant organisms (MDROs) have become a serious problem in infections so herbal compounds that function as antibiotics are required. One of the herbal compounds is mangrove fruit. The aim of this research is to determine the activity of the ethanol extract of fruits from three mangrove species (*Rhizophora mucronata*, *Sonneratia alba*, and *S. caseolaris*) against methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) and extended-spectrum beta-lactamase *E. coli* (ESBL *E. coli*). This research began with the extraction of three types of mangrove fruits using the maceration method with ethanol as a solvent. The anti-MDR bacterial activity was evaluated by diffusion and dilution methods. Inhibition zone of mangrove extract determined by diffusion method, while MIC and MBC values determine by the dilution method. It was found that the ethanolic extract of mangrove fruit had antibacterial activity in inhibiting the growth of MRSA, VRE, CRPA, and ESBL *E. coli* with an inhibitory zone diameter of 3-24 mm at concentrations of 10 and 20 mg/mL and MIC and MBC values of  $\leq 20$  mg/mL. The results of the study have proven that the mangrove fruits of *R. mucronata*, *S. alba*, and *S. caseolaris* are potential sources of natural antibacterials against MDR bacteria.

Antibacterial, fruit extract, mangrove, MDR bacteria

## E-11

### Comparison of two drying methods on *H. itama* bee pollen nutrient and its antibacterial properties

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This study aims to determine the sensory characteristics and antibacterial properties of *H. itama* bee pollen extracts. Bee pollen samples were dried by chiller method 4°C (14-22 days) and oven 40°C (8-10 days). During drying, bee pollen was investigated for the sensory value of color, aroma, taste, texture, and antibacterial activity value on *H. itama*. This is the first time to be reported that six bee pollen from East Borneo, provides a level of value almost favored by consumers. The results show that the chiller 4°C method provides color sensory values (4.43 like range), aroma (3.38 moderate range), taste (3.53 moderate likes range), and texture (4.19 likes range) on the type of bee

pollen *H. Itama* is the highest. The antibacterial activity of the *H. Itama* bee pollen extract using the chiller 4°C method was greater against *Staphylococcus aureus* and *Escherichia coli*, with inhibition zones of 11.43 and 9.96 mm, respectively. The minimum inhibitory concentration (MIC) on all antibacterial activities was 6.25 µL/ml. By comparing the organoleptic characteristics of bee pollen, the chiller 4°C method for 14 days was found to maintain its quality attributes better than the oven-dried 40°C bee pollen method.

Antibacterial *H. itama*, bee pollen, sensory test

## **E-12**

### **Food crops cultivation in peatland of Kalimantan, Indonesia: Potential, constraints, and opportunity in future**

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Indonesia has 13.43 million hectares of peatland, the fourth largest in the world. For a long time, people in Kalimantan have used peatlands for agriculture, including food crops. Policies supported for peatland use in Kalimantan had been recorded since 1890 by the land clearing of the Anjir Serapat area, followed by the Dredge, Drain, and Reclamation Project in 1956-1958, continued by the Tidal Rice Field Clearing Project from 1969-1984, and then the One Million Hectare Peatland Development Project 995-2010. The food crisis conditions faced in the early 1970s to 1983 and 1997/1998, prompted the government to clear peatlands. Information on peatland cultivation and management for agriculture has still debated and confusing, so precise and wise synthesis and analysis are needed. This paper aims to present a review of the utilization and efforts to increase the productivity of food crops, especially rice on peatlands, related to the potential, constraints, and opportunities for the future, along with the rapid land conversion and levelling off rice yields on fertile lands. In the future, the food needs will be grown in line with the rate of population growth, while the area of agricultural land is shrinking and declining due to land conversion and land degradation.

Food barn, Kalimantan, peatland, rice cultivation, sustainability

## **E-13**

### **Morphological responses and potential of different sorghum varieties for phytoremediation of cadmium-contaminated soil**

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Cadmium contamination is one of the important issues in agricultural land and remediation of Cd pollution is of great significance for food production as well as human health. This study aimed to identify and characterize morphological sweet sorghum and select a variety of candidates for phytoremediator. Six varieties of sorghum namely, Super-1, Samurai-1, Suri-3, Numbu, Kawali, and Hitam were evaluated at cadmium-contaminated paddy fields. Morphological characterization based on 31 morphological traits DUS guidelines from PPV and FRA. The observation was divided into two characters, namely qualitative with 22 traits and 11 quantitative plus 3 additional traits. Based on qualitative traits, varieties were assessed for distinctness and grouped, namely: Time of panicle emergence, plant height, panicle shape, and caryopsis color. Three classes as follow: Class 1, time of panicle emergence: very early (Super-1, Suri-3, Numbu, and Black); Plant height: long (Super-1), Medium (Suri-3), Short (Numbu and Black); Panicle shape: panicle broader in the upper part (Numbu), Symmetric (Super-1 and Suri-3), Pyramidal (Black); Caryopsis color: white (Super-1), Grayed orange (Suri-3 and Black), Yellow-orange (Numbu). Class 2, Time of panicle emergence: easy (Samurai-1); Plant height: medium (Samurai-1); Panicle shape: panicle broader in the lower part (Samurai-1); Caryopsis color: Yellow-orange (Samurai-1). Class 3, Time of panicle emergence: Medium (Kawali); Plant height: Medium (Kawali); Panicle shape: panicle broader in the lower part (Kawali); Caryopsis color: Yellow-white (Kawali). Assessment of quantitative traits revealed that plant fresh weight had a positive significant correlation with plant height R1, plant height R5, stem diameter, leaf width blade, thousand-grain weight, and sugar stem content. Several varieties, namely Super-1, Samurai-1 dan Kawali, were found to be excellent in quantitative traits and also showed variations in Cd concertation and BCF value to provide a solid varietal basis for selecting varieties as phytoremediators.

DUS guidelines, morphology character, phytoremediation, sweet sorghum

## **E-14**

### **Bile duck ligation as fast animal model for liver fibrosis in the white rats**

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This study aims to prove that BDL is the fastest animal model and definitely causes liver fibrosis. This method is said to have a rapid effect on fibrotic conditions because it causes obstruction of the bile ducts. In this study, we conducted experiments with nine male white rats of the Wistar strain, which were performed by binding and cutting the bile duct in the section leading to the duodenum. Of the thirty six white rats were divided into 3 treatment groups based on the length of time in the necropsy to see the condition of fibrosis. The treatment of the first group was necropsy on the 3<sup>rd</sup> day after BDL, the treatment of the second group was necropsy on the 7<sup>th</sup> day after BDL, and the treatment of the third group was necropsy on the 21<sup>st</sup> day after BDL. The histopathological conditions of fibrosis in the liver of white rats have undergone fibrosis with different levels, based on the results of metavir scoring, it was found that on the 3<sup>rd</sup> and 7<sup>th</sup> day, portal vein fibrosis was found without the formation of septa or minimal connective tissue (mild to moderate fibrosis). The 21<sup>st</sup> found fibrosis with rare septa formed around the portal vein and accompanied by connective tissue around it (significant fibrosis), so it can be concluded that from day 3 after BDL fibrosis has occurred.

Experimental animal, fibrosis condition, white rats

## **E-15**

### **Diagnosis of liver health status of wild cats in West Surabaya Market, Indonesia using ultrasonography (USG)**

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This study aims to investigate the health conditions of the liver and find out hepatic changes among stray cats in the traditional markets in West Surabaya by interpreting the sonogram using ultrasound (USG) examination. The focus of this study was on two goals, namely 1) identifying the clinical symptoms of stray cats in the traditional markets in West Surabaya that had suspected liver health conditions showing positive results on ultrasound examination and 2) finding out hepatic changes among stray cats in the traditional markets in West Surabaya on ultrasound examination with a frequency of 5.4 MHz according to the maximum frequency of the device. This study used a descriptive exploratory method by conducting an ultrasound examination of the abdominal area of the stray

cats and interpreting the results. From the samples of 12 cats, there was no hepatic change in the results of liver ultrasound imaging. This shows that the cats in the traditional market in West Surabaya do not appear to have any indications of liver diseases on ultrasound results although the stray cats that were found were thin and had enlarged stomachs, without jaundice. Indicates that the gallbladder is of normal size, anechoic echogenicity, portal vein anechoic and hepatic lobe hypoechoic.

High frequency, liver, stray cats, ultrasonography

## **E-16**

### **Isolation, characterization, and in vitro potential of lactic acid bacteria from spent oyster mushroom substrate**

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Spent mushroom substrate from *Pleurotus ostreatus* is one of the agricultural wastes that has lignocellulose, protein, and starch. In addition, it also has cellulase and lignin peroxidase activity that can be used as a source of lactic acid bacteria (LAB). This study was conducted in order to perform the existence of indigenous bacteria of spent oyster mushroom substrate, determine the characterization, in-vitro potential, and hemolysis ability of isolates of LAB. The research method was conducted by survey and analyzed descriptively. The results showed that in the spent mushroom substrate from *Pleurotus ostreatus* found of fermentative, cellulolytic, lignolytic, amyolytic, and proteolytic bacteria. There were 6 of LAB isolates were - hemolytic code PPDG1, PPDG2, PPDG3, PPK3, PPP2, and PPP3. The LAB isolates has higher potential index of fermentative is PPDG2, higher of potential index of cellulolytic is PPDG3, higher of potential index of amyolytic is PPDG, higher of potential index of lignolytic is PPP3, and higher of potential index of proteolytic is PPDG3.

Hemolysis, LAB, lignocelullulose, potential, spent mushroom substrate

## **E-17**

### **Productivity of comet fish (*Carassius auratus*) and plant in aquaponic system using Fine Bubbles (Fbs)**

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This study aims to determine the application of FBs pressure that can increase the productivity of comet fish and plant cultivation in aquaponics systems. The research was conducted in January-March 2022 at the Ciparanje

Green House, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Jatinangor. This study used an experimental method of Completely Randomized Design (CRD) with four treatments and three replications. The treatments used were FBs pressure of 0 atm (A), 5.25 atm (B), 5.5 atm (C), 5.75 atm (D). Maintenance of test fish for 30 days. Observation of fish growth by sampling is done by taking 10% fish from the total population at random in each pond. Observation of the growth of land kangkung was carried out by sampling which was carried out every seven days. The number of plants observed was seven plants in each treatment. The results showed that given FBs pressure of 5.75, the specific daily growth rate was 2.51%, the absolute length growth was 3.33%, the absolute weight growth was 1.70 grams and the survival value of fish was 99.3% and resulted in the growth of kale plant height 128.83 cm, the growth of plant weight was 140.60 g, and the growth of the number of leaves was 284 leaves.

Aquaculture, aquaponics, comet fish, fine bubbles

## **E-18**

### **Water quality in aquaponic systems with addition of Fine Bubbles (FBs)**

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This study aims to determine the application of FBs pressure that can improve water quality in an aquaponic system with fine bubbles (FBs) technology. The research was conducted in January-March 2022 at the Ciparanje Green House, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Jatinangor. This study used an experimental method of Completely Randomized Design (CRD) with four treatments and three replications. The treatments used were FBs pressure of 0 atm (A), 5.25 atm (B), 5.5 atm (C), 5.75 atm (D). The water quality parameters measured consisted of physical (temperature), chemical (dissolved oxygen, pH, ammonia, and nitrate) parameters. The results showed that the pressure of FBs 5.75 resulted in temperatures ranging from 24.4°C - 26.5°C, dissolved oxygen content of 7.83 mg/L, pH 6.98 - 8.07, ammonia concentration 0.002 mg/L, which effect on good fish growth and nitrate concentration 0.316 mg/L which affects higher plant productivity.

Aquaponics, comet fish, fine bubbles, water quality

## **E-19**

### **Characterization of the gene encoding L-Asparaginase type 1 from Thermohalophilic bacteria isolated from Wawolesea Hot Springs, Southeast Sulawesi, Indonesia**

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This study aims to determine the molecular characteristics of type 1 L-Asparaginase encoding gene of thermohalophilic bacteria CAT3.4 isolate from wawolesea hot springs north konawe southeast sulawesi. This research is an exploratory type of research. Characterization was carried out by amplifying the ansA gene sequences encoding type 1 L-Asparaginase from CAT3.4 isolates with polymerase chain reactions (PCR) technique using AsnBac1-F1 (5'-ACGCGATTCTTTGGCCGG-3') and AsnBac1-R1 (5'-CAGTGAAGAGGT GCATGGTATG-3') primers. Amplified PCR products were then used for sequencing templates using the Sanger method. The amino acids coding region (CDS) obtained were characterized bioinformatically using the NCBI website for BLASTn analysis, BioEdit program for restriction sites and hydrophobicity profile analysis, MEGA X program for phylogenetic tree analysis and ExPasy translate program for the analysis of amino acid sequence of type 1 L-Asparaginase. The characterization results showed that the gen had high similarity with the ansA gene sequences owned by 20 strains of *Bacillus subtilis* with 99% -100% similarity, the gene also had high sequence relatedness with ansA gene from *Bacillus subtilis* strain SRCM103629 and *B. subtilis* strain GOT9, can be identified using the restriction enzymes MluI and BstI as a species differentiator of the producing organism, the CDS encoding 329 amino acids with the dominant composition of polar amino acids (54.1%) and having an amino acid hydrophobicity profile which is dominated by hydrophilic region. All of these characters confirmed that the characterized gene was ansA gene encoding type 1 L-Asparaginase of the species *Bacillus subtilis*.

Bioinformatics, characterization, gene, L-Asparaginase

## **E-20**

### **Antifertility effects of *Averrhoa bilimbi* fruit ethanol extract on histology of the ovarium *Rattus norvegicus* wistar female**

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Prevention of reproductive system fertility can use a compound that is antifertility. Antifertility derived from plants can be an alternative to reduce the side effects of using synthetic antifertility. Wuluh starfruit (*Averrhoa bilimbi*) is known to have potential as antifertility because it contains chemical compounds including flavonoids, tannins, saponins, triterpenoids, alkaloids, steroids and oxalic acid. The purpose of this study was to determine the antifertility effect of the ethanolic extract of star fruit wuluh on the ovarian histology of female Wistar rats. The research method used a completely randomized design

(CRD) with three treatments and six repetitions using 18 rats. The composition of the treatment consisted of: KN (1% Tween 80); KP (birth control pills 1.4 mg/kg BW); BW (ethanol extract of *A. bilimbi* 570 mg/kg BW) administered orally for 14 days. Ovarian histological parameters observed included the number of primordial, primary, secondary, degraaf follicles, and corpus luteum. The data obtained were analyzed using the one-way ANOVA method (analysis of variance) at the 95% confidence level and Duncan's Multiple Distance Test. The results showed that the ethanol extract of star fruit wuluh significantly ( $p < 0.05$ ) decreased the number of primordial follicles (10.17%), primary follicles (27.85%), secondary follicles (20.73%), graaf (43.42%) and corpus luteum (21.04%). Based on the results of the study, it can be concluded that the administration of ethanol extract of starfruit at a dose of 570 mg/kg BW affected the histology of the ovaries.

*Averrhoa bilimbi* extract, antifertility, female Wistar rats, ovarian histology

## **E-21**

### **Sustainability level of mangrove forest management based on RAP-Mforest approach in Pancer Cengkong, Trenggalek District, Indonesia**

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Mangrove forest area is a coastal resource that is beneficial for the welfare of the community. Protection and preservation of the mangrove ecosystem need to be carried out by taking into account various aspects to achieve sustainability. This research was conducted in the Pancer Cengkong Mangrove Forest, Karanggandu Village, Watulimo Sub-district, Trenggalek District, East Java. This research was conducted in June 2022 through literature study and field interviews. Three dimensions (ecological, economic, and social) were selected along with their attributes. Each attribute was scored to indicate the status of sustainability. Then, the data obtained were processed by multidimensional scaling (MDS) analysis using the Rapid Appraisal for Mangrove Forest (RAP-MForest) method. Furthermore, leverage analysis is made to determine the sensitive attributes in each dimension. The results depicted that management in Pancer Cengkong Mangrove Forest is less sustainable in economy dimension and fairly sustainable in the two remaining dimensions. Social dimension achieved the highest sustainability index value at 72.92. This study also managed to know the sensitive

attributes from each dimension. By knowing the sustainability index and sensitive factors, it can help provide recommendations for management in the Pancer Cengkong mangrove area to achieve a sustainable level.

MDS, mangrove management, RAP-Mforest, Pancer Cengkong

## **E-22**

### **Mangrove conservation efforts with the ecotourism development in the Cengkong Mangrove Ecotourism, Trenggalek District, East Java, Indonesia**

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The development of the Cengkong Mangrove ecotourism, Trenggalek, Indonesia must be carried out as an effort to develop natural tourism with very careful consideration in its management, without a temporary benefit orientation, and the perpetrators must have benchmarks in the sustainable development process so that it remains sustainable and future generations can use it in the future. This research examined conservation and ecotourism efforts by the community around the Cengkong Mangrove Ecotourism and social perceptions of ecotourism based on mangrove development. The research was conducted in June 2022 at Mangrove Cengkong Ecotourism, Karanggandu Village, Watulimo Sub-district, Trenggalek District, East Java, Indonesia, by conducting interviews with 50 respondents. Data was collected through field observations and interviews with ecotourism administrators and residents around the location. The results of this study indicate that the conservation efforts carried out are protecting, conserving, and utilizing mangroves by seeding, planting, managing, and monitoring mangroves. The Cengkong Mangrove Ecotourism area is managed by the *Kelompok Masyarakat Pengawas (POKMASWAS)* or the Community Monitoring Group. However, the utilization of mangrove forest resources that have economic value by the community around the Cengkong Mangrove Ecotourism area is still low because it is only limited to the cultivation of crabs, shells, making mangrove syrup, cakes and chips. Indeed, area development still lacks preservation, utilization, and conservation for the management, surrounding communities, and tourists. Limited facilities and infrastructure are a challenge for the sustainable development of mangrove ecotourism. In addition, increasing community involvement and collaboration with institutions and the government in mangrove management

must also be improved so that all the surrounding communities can also benefit. With the increasing economic benefits of mangrove ecotourism management, the community around the mangrove forest will participate in maintaining and preserving the mangrove forest ecosystem.

Community, conserving, protecting, utilizing