PROCEEDING OF

International Conference on Biodiversity for Life:

Sustainable Development of Indonesia Biodiversity

October 21, 2019

Editor :

Imran SL. Tobing

Fitriah Basalamah

Astri Zulfa

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International Conference on Biodiversity for Life: SUISTANABLE DEVELOPMENT OF INDONESIA BIODIVERSITY

Jakarta, October 21st, 2019

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Imran S.L Tobing
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FOREWORD COMMITTEE

Praise be to God Almighty for the blessings of his grace, and that we were given opportunity to be able to complete a smoothly and well for International Conference on Biodiversity for Life. We prepared this event in a series of activities to welcome the 70th Anniversary of the UniversitasNasional.

"Sustainable Development of Indonesia Biodiversity", were selected as the theme of this conference for raising our awareness that our country has a very abundant biodiversity than any other countries in the world, so it will be understandable that how we should preserve our natural richness wisely and utilize sustainably.

The booklet is aiming to make conference participants easier to find information related to this activity, such as the registration, schedule of events and abstracts from the speakers.

We are aware that there are still many deficiencies that we need to correct in conducting the conference, as well as in the compilation of the booklet. Thus, we expect criticism and suggestions from all of you so that we can do better in carrying out similar things in the future.

Finally, we say thank you to all those who have supported the International Conference running smoothly.

Jakarta, October 2019

Organizing Committee

WELCOMING SPEECH

Assalamu‘alaikum Warahmatullahi Wabarakaatuh,

Your Excellency, Mr. Prof. Dr. Iskandar Fitri, ST. MT. (Vice Rector for Academic - UNAS)

Your Excellency, Mr. Prof. Dr. Dedy Darnaedi (Keynote Speaker, UNAS);

Your Excellency, Mrs. Prof. Dr. Ernawati Sinaga, MS. Apt. (Invited Speaker, UNAS)

Your Excellency, Mr. Prof. Dr. rer.nat. Imam Widhiono MZ, MSc. (Invited Speaker from UNSOED, Purwokerto)

Your Excellency, Mr. Dr. Rob Stuebing (Invited Speaker from PT. REA Kaltim Plantations)

Your Excellency, Mr. Dr. Bernart Ripoll Capilla (Invited Speaker from Borneo Nature Foundation)

Your Excellency, Mr. Dr. Godwin Limberg (Invited Speaker from PT. Daemeter Consulting)

Dear Lecturers, researchers, biodiversity observers, and students; both as a speaker and conference participant,

Welcome to Jakarta (for participants from outside Jakarta); welcome to the Universitas Nasional; welcome to the International Conference on ***"Biodiversity for Life"*** with the title ***"Sustainable Development of Indonesia Biodiversity".***

The conference is part of series activities in celebrating the 70th Anniversary of the Universitas Nasional and also the Faculty of Biology.

Indonesia is a mega-diversity country; this natural richness is a gift that must be utilized as a basic capital of development for the maximum welfare for all Indonesian people. Biodiversity wealth will never run out if it’s managed in sustainable way because biodiversity is renewable.

The trend for biodiversity utilization is still limited into several types following to market demand; even though Indonesia's biodiversity is very rich with the potential of various types that have not even been revealed yet. Research on Indonesia's biodiversity richness needs to be encouraged to uncover the potential of Indonesia's biodiversity. Furthermore, development is absolutely must be carried out so that Indonesia's biodiversity has added value to empowered people’s life, while at the same time maintaining the balance of the earth's ecosystems.

Therefore the conference is designed to summarize the results of research on Indonesian biodiversity; both to assess ecological conditions, reveal the potential and various

biodiversity developments that have been carried out by researchers. The results of the research are planning to be published in a seminar proceeding are expected to be part of the research contributions in an effort to uncover various alternative models of Indonesian biodiversity utilization to maintain the earth life balance.

This conference will feature a keynote speaker ", namely Mr. Prof. Dr. Dedy Darnaedi, whom very familiar to all of us. He is also an alumni of Faculty of Biology-UNAS. One of the main fields of interest is Plant Biosystemics. His presentation at this conference is about "*Diversity and the Beauty of Tropical Ferns: A new paradigm in managing Indonesia Biodiversity"*

Next; will also feature five "invited speakers" from academics, NGOs and the private sector, which are:

- Prof. Dr. Ernawati Sinaga (Vice Rector for Research, Community Services and Cooperation - UNAS)
- Mr. Prof. Dr. rer.nat. Imam Widhiono MZ, MSc. (Dean of the Faculty of Biology, Soedirman University, Purwokerto)
- Mr. Dr. Robert Butler Stuebing M.A. (Technical Advisor, REA Holdings/PT. REA Kaltim)
- Mr. Dr, Bernart Ripoll Capilla (Co-Director of Borneo Nature Foundation)
- Mr. Dr. Godwin Limberg (Regional Manager of PT. Daemeter Consulting)

With additional 38 speakers and researchers, both from local and international.

Be fully attention to the papers that will be presented at this conference. Thank you for your willingness to participate in this conference; We hope our concern for Indonesia's biodiversity increases; so that it can be more utilized as a basic effort to maintain the Earth's ecosystem balance.

Finally; on behalf of the entire committee, we do apologize for all the limitations and deficiencies in planning, welcoming and holding this conference.

Much appreciated and thanks for the hard work of all organizers of the conference, the sponsors (Borneo Nature Foundation and Yayasan Palung), as well as other parties that I cannot mention all. Hopefully your help will be a blessing for all of us.

Congratulation for the conference; be sure to have knowledge sharing and experience. Hopefully it will be useful for science development and for decision makers, to better synergize the interests amongst all components of the ecosystem for earth life balance.

Wassalamu’alaikum Warahmatullahi Wabarakaatuh.

Jakarta, 21 October 2019

Chief of the Organizing Committe

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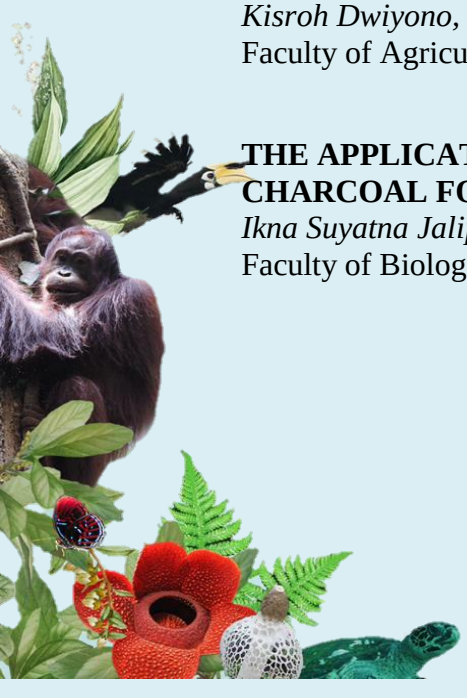

INSECT POLLINATORS CONSERVATION STRATEGIES

Imam Widhiono
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Abstract

Insect pollinators play an important functional role in most terrestrial ecosystems. Because they provide a key ecosystem service vital to the maintenance of wild and agricultural plant communities. However in the past decade, insect pollinators were considered to be in a state of decline due to a range of recent environmental changes, such as habitat loss and fragmentation, agriculture intensification and climate change. Insect pollinators diversity in a habitat will guarantee the success of pollination compared to only one species of insect, because the diversity of species of pollinating insects will result in diversity of time and space pollination as well as the diversity of behavior of pollinating insects in foraging activities that will complement each other with one others. The aims of this paper was to describe the methods of insect pollinators conservation in agriculture landscape. The results of Widhiono's research (2015) on agricultural landscapes with various plants found 17 species of pollinating insects compared to land with monoculture plants found only 5 species. Habitat with a higher number of wild flowering species can produce a greater diversity of pollinating insects than natural forests (Widhiono et al, 2016). Natural habitat also plays an important role in maintaining the diversity and abundance of pollinating insects, the results of the study of Widhiono and Sudiana (2016) show that the diversity of pollinating insects on land close to forest boundaries is higher than that far from forests, because plantations are able to maintain diversity and abundance pollinating insects (Widhiono et al, 2018).Based of the result, the selection of model-based habitat conservation methods for insect pollinators are on the theory that diversity and abundance of pollinating insects depend on the size of the habitat, habitat quality, and the potential for positive interaction with other habitats. Among these factors, the most important are habitat quality and the number and diversity of wild flowering plants as food supply for pollinating insects throughout the year.

Keywords : Diversity, flowering plant, habitat quality, insect, pollinators

I. INTRODUCTION

Insect pollinators play an essential functional role in most terrestrial ecosystems. Because they provide an essential ecosystem service vital to the maintenance of wild and agricultural plant communities (Potts et al., 2010; Albrecht et al., 2012). A large proportion plant that the human diet depends directly or indirectly on insect pollination (Klein et al., 2007; Albrecht et al., 2012; Garibaldi et al., 2013). According to Potts et al (2010) insects are the primary animal-mediated pollinators of 80% of all plant species of the world, including most fruits, many vegetables and some biofuel crops. Insect pollinators contain diverse species of *Hymenoptera* (bees, solitary

species, bumblebees, pollen wasps and ants), *Diptera* (bee flies, houseflies, hoverflies), *Lepidoptera* (butterflies and moths), *Coleoptera* (flower beetles), and other insects.

In the past decade, insect pollinators were considered to be in a state of decline due to a range of recent environmental changes, such as habitat loss and fragmentation, agriculture intensification and climate change (Potts et al., 2010). Winfree (2010) states that bee pollinators are under pressure from human activities, and bee decline is often linked to habitat change and loss (Winfree et al., 2009; Potts et al., 2010). Many natural habitats have been destroyed or fragmented by urbanization and agricultural intensification with parallel declines observed in the diversity and abundance of insect pollinators (Steffan-Dewenter et al., 2002; Ricketts, 2004).

Anthropogenic changes to habitat may confound underlying and interacting effects that regulate insect pollinators populations, mainly food resource availability (Roulston and Goodell, 2011). Bees typically find a constant supply of floral resources in semi-natural habitats, which provide a high diversity of plants (Roulston and Goodell, 2011, Widhiono and Sudiana, 2017). In contrast, in intensively managed agricultural monocultures, food resources are only abundant during the short flowering seasons of crops (Decourtye et al., 2010). Subsequent shortages in food resources throughout the rest of the year have been linked to decreasing insect pollinator's diversity and abundance in agriculture habitats (Naug, 2009). Foraging activity on the colony level is regulated by (1) the number of resources stored within the nest and (2) the availability of resources in the environment (Altaye et al., 2010). Foraging activity and patterns of colonies with similar food storages, but located in different environments, should, therefore, be mainly determined by the availability of resources in the respective landscapes.

Insect pollinators diversity in a habitat will guarantee the success of pollination compared to only one species of insect, because the diversity of species of pollinating insects will result in variety of time and space pollination as well as the diversity of behavior of pollinating insects in foraging activities that will complement each other with one other (Widhiono, 2015). The ability of the difference of pollinating insects as a pollinating safety network and increasing the capacity to pollinate is very dependent on the ability of the community to function in a variety of environmental conditions (Kremen, 2005).

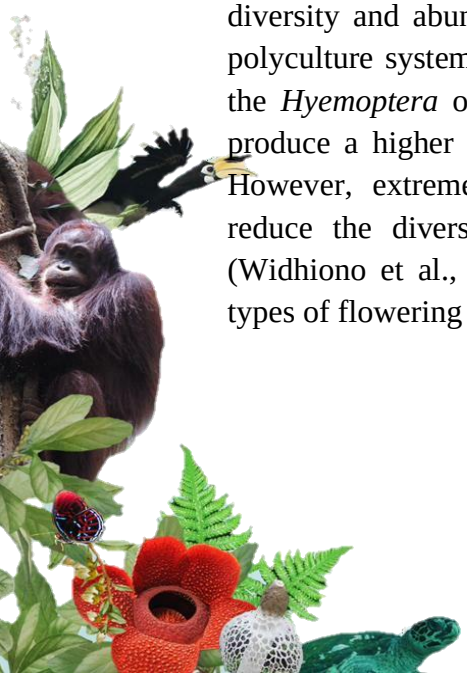
To reduce the decrease in diversity and abundance, and increase the role of environmental services provided by pollinating insects, conservation efforts are needed. The objective of this paper was to review the strategy of insect pollinators conservation in Java.

II. CONSERVATIONSTRATEGY

Insect pollinators diversity in a habitat will guarantee the success of pollination compared to only one species of insect, because the diversity of species of pollinating insects will result in variety of time and space pollination as well as the diversity of behavior of pollinating insects in foraging activities that will complement each other with one other (Widhiono, 2015). The ability of the difference of pollinating insects as a pollinating safety network and increasing the capacity to pollinate is very dependent on the strength of the community to function in a variety of environmental conditions (Kremen, 2005). Therefore it is vital to maintain and increase the diversity and abundance of pollinating insects in a habitat.

The selection of model-based habitat conservation methods for insect pollinators is on the theory that diversity and abundance of pollinating insects depend on the size of the habitat, habitat quality, and the potential for positive interaction with other habitats. Among these factors, the most important are habitat quality and the number and diversity of wild flowering plants as a food supply for pollinating insects throughout the year. One approach to managing floral diversity and optimize pollination involves cultivating the most suitable flower species for targeted insects, as wildflower plantings could provide pollen and nectar resources when the crop is not in bloom (Carvell et al., 2007). More extensive plantings of flowers could support greater diversity and an increased abundance of insect pollinators; therefore, conservation methods for insect pollinators on agricultural land are based on the concept of species enrichment and density of wild plants as food resources for these insects (Rollin et al., 2013).

The results of Widhiono's research (2015) on agricultural landscapes with various plants found 17 species of pollinating insects compared to land with monoculture plants found only five species. Habitat with a higher number of wild flowering species can produce a greater diversity of pollinating insects than natural forests (Widhiono et al., 2016). Natural habitat also plays a vital role in maintaining the variety and abundance of pollinating insects, the results of the study of Widhiono and Sudiana (2016) show that the diversity of pollinating insects on land close to forest boundaries is higher than that far from forests, because plantations are able to maintain diversity and abundance pollinating insects (Widhiono et al., 2018) Agriculture with polyculture system has been proven to bring more pollinating insects, especially from the *Hyemoptera* order compared to monoculture farming (Christina, 2017). So as to produce a higher level of pollination in strawberry plants (Kusumarini et al., 2017). However, extreme environmental factors, especially temperature and rainfall will reduce the diversity and abundance of pollinating insects, including honey bees (Widhiono et al., 2018) whose results are mainly caused by declining numbers and types of flowering plants on agricultural land. The latest research results withthe



enrichment model of flowering plants with caisim plants and wild flowering plants have shown very real results on the growth of honey bee colonies (Apis spp and Stingless bee). They are able to develop throughout the year even in the dry season.

III. CONCLUSSION

Based on the result can be concluded that

1. Conservation strategy of insect pollinator in the agriculture habitat shouldbe considered diversity and total number of flowers as mainfood
2. The economic impact of using land enrichment plants must becalculated

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CONSERVATION AND THE OIL PALMIST

Rob Stuebing
Technical Advisor, Conservation Department, PT. REA Kaltim Plantations, East Kalimantan

I. INTRODUCTION

I first encountered my first oil palm estate in 1975 while motorcycling through newly opened land in Jengka, Pahang (Malaysia). Bare orange earth shimmered in the midday heat, in contrast an unbroken blanket of dark green forest that still cloaked upper hillsides. It was 1974 and FELDA [1] was new, and so was its crop, *Elaeis guineensis* or, oil palm. The original, intact forests of Peninsular Malaysia's west coast patchy with rubber estates, the view of Jengka's new landscape was in one way, impressive.

Gaveau et al. (2014) estimated that in 1973 around 75% of Kalimantan was still forested, but by 2010, approximately half had disappeared. For centuries these same forests had retained mixture of original and regenerating growth, the latter as regenerating swidden plots along interior rivers. Chain saws (and bulldozers) shifted the balance however, and allowed a single man to do the work of a village in a fraction of the time. Thus the Kalimantan landscape changed dramatically change within a span of less than 40 years. A steady chain of economic resource substitution penetrated far into the interior of the landscape, not always with local benefits in mind (Chao et al., 2012). Timber was a rapidly convertible economic product, required little supporting technology and provided rapid economic returns. As densities of high value timber species disappeared however, an attempt at resource replacement in the form of fast growing trees, monocultures of *Acacia*, *Eucalyptus*, etc supplanted the now vast, logged over landscapes. Unfortunately, lightweight short fiber wood produced but a fraction of the original economic returns of the original forest, in cycles of up to ten years before harvest and sale. There must be something more productive, valuable and renewable, it was assumed. By 1980, there was: a new and vastly more valuable tree crop, *Elaeis guinaeensis*, oil palm. Planted experimentally in Sumatra many decades earlier, the crop demonstrated that high value economic yields per hectare were not a thing of the past. In fact there was an unexpectedly explosive demand for a single product from trees that would produced for at least 20 years: palm oil. Thus the final stage of primary resource substitution had been reached: Forests (subsistence) -> Forest (Commercial)-> Forest (Industrial-exotic) and finally, oil palm, possibly the richest of all. The new plantation industry swept rapidly across the landscape as conservationists scolded and cajoled an increasinglymoribundtimberindustrythathadsystematicallyworkeditswayoutofa

[1] Land Development Authority, Malaysia

job. Even Acacia could not plug the leak in profits, or produce the levels of largess to which companies and governments had been previously accustomed. Ironically, within a short measure of years some conservationists began to extol the timber industry as the best hope for saving biodiversity. But for local governments, what could they profitably do with logged over land when rubber prices were falling?

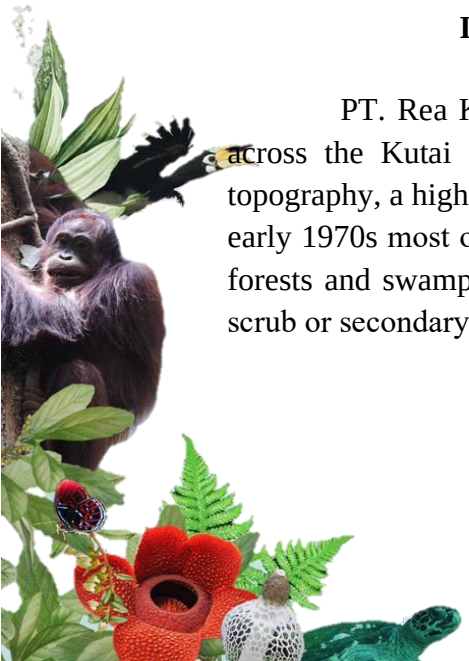
The early days of oil palm plantation development were obviously focused on economic possibilities. Rural ex-logging land was seemingly abundant, since most of it possessed only customary, but not registered, legal titles, and rural residents were also in need of monetary income within a cash economy. The industry's early focus was how to solve the technical planting and maintenance challenges thwarting efficient production. Robust production of a valuable export commodity was top priority. Nevertheless, strangely, controversy continues about what oil palm is and does, and why it is or isn't a total blight on the landscape. A quote by the neuroscientist and author, Dr. Vilayanur S. Ramachandran, is relevant: "*Every act of perception requires an act of judgment*." This statement is applies to both the supporters and detractors of the oil palm industry. But the truth lies in the science, not in thepolitics.

East Kalimantan remains one of Indonesia's richest Provinces, and continues to develop rapidly. Proper conservation policy, planning and management have needed to evolve rapidly to keep pace, especially for biodiversity, but have been chronically falling behind. As of 2018, an estimated 1,600,000 hectares of oil palm plantations had been developed in East Kalimantan (Antara News,2019).

During the early decades of oil palm plantation development, companies rarely set aside forested areas within their HGU boundaries for Conservation. The function of forests and wetlands within a plantation thus could not be studied, and least of all, understood. Long-term benefits from surrounding natural areas were assumed to be non-existent, while negative aspects such as difficult terrain for cultivation (steep slopes, extensive wetlands) or invasion by pests were viewed in a negative light. Conservation Reserves are not just isolated areas with mature trees, but functional units of a plantation. Benefits include clean water, access to forest products such as wild vegetables, fish and game, and improved community relations via recognizing and honoring local customs and traditions that include the management of forestresources.

II. PT. REA KALTIM ANDCONSERVATION

PT. Rea Kaltim Plantations began planting in 1996 within the upper Belayan across the Kutai Kartanegara Regency, a landscape with low lying and often flat topography, a high water table and substantial wetland areas. As described above, by the early 1970s most of the marketable timber had been harvested from the area's dry land forests and swampy terrain, leaving behind extensive areas of tangled, open canopied scrub or secondary growth. Portions of logged areas within REA Group's *Hak Guna*



Usaha (HGU, or Land Title) burned during widespread fires during severe ENSO[2] droughts in 1982-83, 1997-98 and 2015-16 (Chao et al., 2012). Some sites have regenerated only to form a mixture of coarse shrubs and *Imperata* grass. Other residual forested habitats, still possessed remnants of the previously forested ecosystem. The landscape continues to evolve into a complex mosaic of forested patches, ex-shifting cultivation and plantation monocultures. In several detailed reports, Whitmore & MacKenzie (1995), Troppenbos International (2006) and Purseglove (2005) describe many characteristics of the original forest of the Hulu Belayan area dating back to. Both Whitmore and Purseglove have asserted that East Kalimantan formerly contained some of the "most magnificent forests" in the region. They became one of the richest sources of high value timber, such as Meranti, Keruing and Agathis (Chao et al., 2012). These perceptions, both about the forests and their species "should be" based on what they were, have been slow to change. Images of pristine forests full of majestic dipterocarps, orchids and orangutans, solid green habitats intersected by crystal clear rivers – continue to be central to the perception of what success (or failure) should result from the implementation of a conservationprogram.

Natural forest remnants in Hulu Belayan, despite damage by logging, fires and human intrusions, still possess significant numbers of original, including RTE species. The potential of these areas to regenerate into mature forest ecosystems remains high, even though the community will of a different character from the original (McShea et al., 2009). If managed wisely, much of the original biodiversity of the landscape will still be found there. The question remains, apart from "benign neglect", what measures can be taken to restore, enhance or even "rewild" a mixed use landscape of remnant forests and oil palm plantations? How might practical remedies beapplied?

III. PRACTICALCONSERVATION

PT. REA Kaltim began its first planting in 1994, well after environmental and biological conditions of the landscape forests had been degraded by logging companies such as PT. Limbang Ganesa, and others (Chao et al., 2012). A tropical forest specialist from Cambridge University (Whitmore & MacKenzie, 1995) authored the first of PT. REA Kaltim's environmental assessments. The company became a member of RSPO in 2007, and In January 2008, and established its own separate Conservation Department (REA KON). REA KON's mission was definedas:

- To maintain or enhance the original landscape levelbiodiversity
- To reduce of eliminated negative humanimpacts
- To ensure that long-term benefits are shared byall

[2] El Niño-Southern Oscillations

Since 2004, when RSPO was first formulated, certification systems have been applied and even proliferated, although conservation as a concept has somewhat receded in favor of "Corporate Social Responsibility (CSR) and "Sustainability". Nevertheless, no incontrovertible evidence has shown that the process of certification has guaranteed significant reversals of deforestation and the population declines of Endangered species (Meijaard et al., 2017; Carlson et al., 2018; Morgans et al., 2018). Does that mean that certification should be abandoned? Should an internal conservation program be preferred over the process of certification and rely completely on short-term consultants to assess conservation values? Perhaps not, it does seem possible that external, prescriptive systems do not yet overcome many of the basic challenges spawned by the progressively wide spread level of landscape alteration that results from plantation development.

Could the original species of the landscape, after many cycles of disturbance (specifically in Hulu Belayan) possibly persist or recover? REA KON's first responsibility was to create and maintain a long-term database derived from long-term surveys and monitoring of the status of floral and faunal communities. Verifiable identification of species and the dynamics and demographics of their natural populations is critical. Then, as a result of finite resources both human and financial, Conservation management then requires prioritization effort for protection of selected species, and the consumptive use of others. The ultimate goal is to augment, sustainable use and to manage the prevailing "crop" of local landscape level biodiversity through a strategy derived from long-term survey, monitoring and assessment. Taxonomic surveys provide an empirical basis to prioritize action for species requiring urgent protection, versus those that may require it least. Inventories and empirical information, not theories nor assumptions must provide the solid foundation for managementdecisions.

Based on empirical data obtained directly from the landscape, conservation principles must then be derived and integrated day-to-day operations, in order to bring produce physical, biological and social benefits. Conspicuous ecological and even social benefits derive from retaining permanently forested, stable Conservation Reserves as forested set-asides along rivers, on steep lands, or on any land unsuitable for planting)[3] . Long-term targets include improved water quality, natural control of pests, increased abundance of fish and other wild protein, and cultural resources including medicinal plants. Social benefits include stable, positive relationships with local communities whose access to forest is maintained. Outcomes are benchmarked, based on evidence that environmental quality has been maintained or enhanced, making landscape level biodiversity conservation an achievable goal. Best practice promotes disciplineinresourceuse,increasesefficiency(reduced/recycledby-productsorwaste)

[3] Within its Belayan Estates, REA Group's Conservation Reserves encompass approximately 20% of the total area of its HGUs. Some land was left unplanted as a result of discussions with local communities. The situation regarding of PFIC by the company has been described in detail by Chao et al 2012.

and enhances community welfare. Such outputs lower the cost of plantation operations apart from improving environmental performance increasingly demanded by international markets.

For biodiversity in particular, REA KON believes that conservation is not a process, but an output achieved from integrating essential ingredients :

Inventory (taxonomy/ecology)+Management (protection/use) = CONSERVATION

Taxonomic inventories form the most basic element of conservation, since managing any species without knowing its identity is at best, a fool's errand. Examination by a qualified taxonomist verifies the identity of a species, provides insights into its ecology, its role in its own biological community and potentially, its conservation status. Most importantly, such hands-on information provides a baseline for monitoring and assessment.

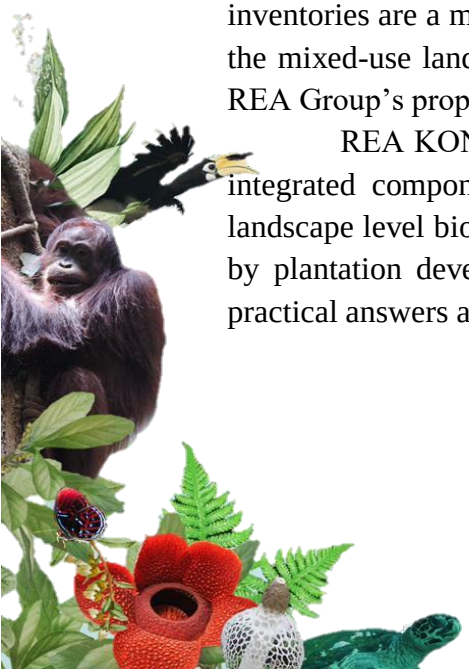
Prioritizing the use of resources for protection, control, or use (or even "benign neglect") can follow. These four options comprise the greater part of management-except for habitat enrichment and/or species translocation that are usually rather limited in scope and options that must be weighed carefully to see if they are cost effective. Fortunately Nature is dynamic-never static-and, as is so often said, "abhors a vacuum". As long as some portion of the original habitat remains, allowing nature to do the work, "self"-recovery is still possible. The catalytic energy that drives conservation staff must be their own passion for this work, and close collaboration with internationally recognized local scientists (Chao et al., 2012).

Managing wild species is guided by a four-part formula proposed by Caughley & Sinclair (1994) :

- Make itincrease
- Make itdecrease
- Harvest it for a sustainedyield
- Leave it alone (but keep an eye on it)

Biodiversity inventories also provide information on traditional, cultural, legal and economic values of local species. Monitoring and assessment determine whether an action taken to achieve conservation is working-or not. Detailed long-term field inventories are a mandatory first step in the process leading to biodiversity conservation the mixed-use landscape mosaic of plantation and secondary forest that surrounds PT. REA Group's properties.

REA KON's management structure (Figure 2) provides for three different, but integrated components to address to basic physical, biological and social needs of landscape level biodiversity conservation. Understanding the ecological changes caused by plantation development is critical to frame questions, and implement appropriate practical answers and then to benchmark progress in achieving conservation objectives.



Knowing the distribution and relative abundance of species, especially those Critically Endangered (Cr), Endangered (En) or Vulnerable (Vu) ones, is the focus of the Biodiversity Management section. The Communities and Forests section works with the other two focus groups to make communities more aware of the needs for and the benefits of long-term conservation, and the importance of sustainable use of any consumptively used wild species.

PT. REA Kaltim's management structure places its Conservation Department directly under the authority of the President Director. For important reasons, REA KON is not directly connected to plantation operations or production. Practical experience has shown that wherever there is a conflict between operations and conservations, conservation must be subservient to increasing palm oil production. That has consistently been a source of the some of the environmental problems for which the industry has been blamed.

The first five years of REA KON's efforts (2008-2012) produced encouraging results: more biodiversity was detected than we had believed possible, including up to 20 species new to science (Stuebing, 2010, were found. These included a breeding population of orangutans, at approximately 180 species of birds, more than 100 species of freshwater fishes (of which at least four were new to science), and numerous rare or endemic plants. Empirical data on all these species was collected under internationally recognized scientific protocols, and identifications by experienced professional taxonomists. Biodiversity conservation has been further enhanced by REA KON's 24 hour/7 days per week presence on the Estates, functioning as an integral part of plantation operations. Short-term consultants are occasionally called upon when special expertise on RTE species or sensitive habitats is needed (Chao et al. 2012).

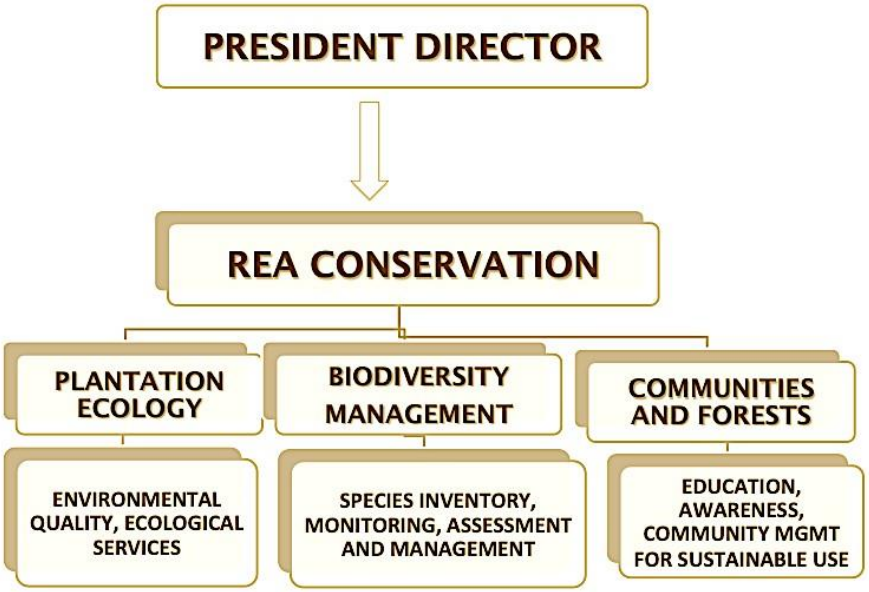


Figure 2. REA KON management structure

IV. REA KON ANDCERTIFICATION

PT. REA Kaltim Plantations received RSPO certification in 2011 (Chao et al. 2012). A question did eventually arise as to whether Conservation Departments should even be relevant in the Age of Certification? Has certification successfully addressed landscape level Endangered species conservation and forest loss? There is a Confucian requirement for success that is worth mentioning here. It is called, "the rectification of names". Its meaning is that, if our language is not correct, and what one says does not conform with what is actually means or does, that which needs to be done will never be accomplished. In other words, we should always use the words appropriate their meaning. In theory, that may sound simple. In practice, it isn't.

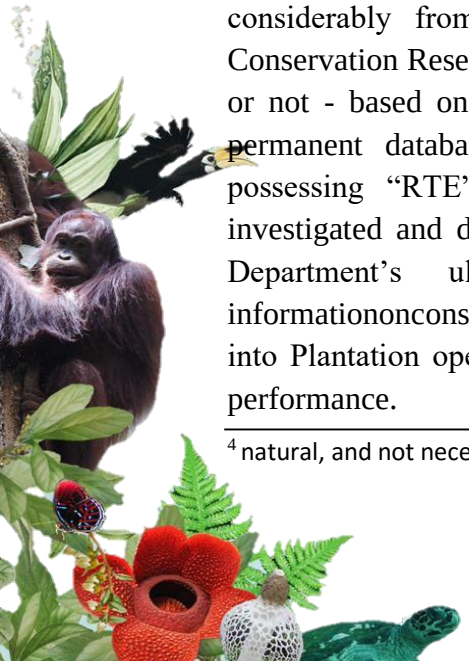
The derogatory term, "green washing" is Confucian in this way, as companies that tout their conservation credentials without having any are violating this important principle. Similarly, agriculture logically is to be done by farmers, but professional estate managers and investors totally altering natural landscapes isn't at all the same thing. One does not generally farm withbulldozers.

One of conservations most beloved concepts, HCV may also be at risk of in this way. This category of conservation was originally derived from the Forest Stewardship Council's Principle 9 of the Principles of Criteria for Forest Certification. Termed the "Precautionary Principle", it proposed that if there was any uncertainty about whether a habitat required protection, that pending improved information, these "High Conservation Value" sites must be protected (Cotter et al.2000).

But the word "high" has a range of definitions, although assumed to refer to enhanced or greater than normal". Once combined with the word "value", the meaning should be immediately clear, that there is something highly desirable involved. Of course, not to forget that the word "conservation" lies in between that may complicate things a bit. Are all HCV set-asides really HCV? And these can come to be regarded by the plantation management as "Other" (in Indonesia or Malaysia, "anak tiri", a "step child").

Plantation manager may conclude that the HCV areas are there really for nothing more than their intrinsic value[4], but protected only by a daunting system of suspensions or fines were there to be damage incurred during development. This approach differs considerably from REA KON's 365 days per year evaluations of "HCV" = Conservation Reserves, which are defined as possessing any *original* habitat – degraded or not - based on scientific, open-ended systematic surveys (that build an extended permanent database), followed by monitoring and assessment. Original habitats possessing "RTE" species are thus not merely identified and demarcated, but investigated and documented -- in detail, and for as long as REA KON exists. The Department's ultimate goal is to eventually integrate all relevant informationonconservation of habitats species and/or community-related forest needs into Plantation operations for a continuous upgrade of REA Kaltim 's environmental performance.

[4] natural, and not necessarily for any other rational reason



The three words represented by the letters HCV, what do they actually mean, not just to supporters of conservation, but to ordinary people, including oil palm plantation owners and operators? Obviously, conservation is in itself a complex concept and can refer to a range of values, biological, traditional, cultural, historic, economic, ethical and perhaps a few more. Plantation owners can agree to at least some of these, but if the concept of includes greater or above normal *economic or even, community value*, who wins? If plantation owners are told what HCV is or should be, by terminology that to them makes little sense, i.e., *something … is called one thing but actually is another*, would they agree. The above is partially of the rationale for the structure and function of REA KON, to add value *to the company* through efficiency, savings and BestPractice.

The trap of any established prescriptive approach. Certification systems can evolve from a theory to a process to a ritual, which does not necessarily build wisdom, insight or ethics. If comfortably settled into the role as a powerful bureaucracy, as time passes as can happen in other sectors[5] (no accusations here!), become ineffectual in solving the principal challenges of its mission, in this case, landscape conservation, deforestation and the decline or loss of Endangered species. The vast footprints of plantations are real and expanding, and as biological entities ourselves, we must be proactive not just prescriptive – if we are not to undermine the life support of our own existence.

It seems that in view of the daunting biodiversity of the Old World tropics, certification systems may face the philosophical conundrum of the "trolley problem"[6]; i.e., who to save? REA Conservation is convinced that species conservation is actually applies to all natural species and is a full time job. Furthermore, REA KON believes that integration of conservation principles directly into operations over years means a much lower probability of the loss of Endangered species and critical forest habitats associated with plantationdevelopment.

What about costs? Is certification cheaper? Is REA KON too expensive for a company, especially when CPO prices fall? A well-run conservation program should not cost money, it should *save* it. Ironically, plain spoken Estate management, in their heart of hearts, do seem to define Conservation Departments (with an eye roll) as not much more than decorative "cost centers": mandatory, expensive, but useless. In fact, if the costs of certification are taken into account *in addition to* the costs a conservation program,thereisnorealcontraryargument.Evencertificationsystemsstillstrugglewith this challenge, wishing to avoid applying the stick without a carrot, although for many small companies, in fact, there may be no carrot. Nevertheless, integrating conservation principles into plantation operations does increase efficiency and does lower costs. No conservation program may ever be credited with this, because only profits, not savings make it into the balance sheets under "Conservation". But a completely staffed and conservation program still costs annually only about one to two per cent of a plantation company's total budget.

[5] External prescriptive system -> Implementation by external assessors -> Bureaucratic inertia -> Obsession with documents -> Undetected environmental deterioration -> Incremental loss of original goals and purpose.

[6] https://en.wikipedia.org/wiki/Trolley_problem

V. CONCLUSION

The real bottom line: in all this: top management does count to enable conservation, but in practice it is the managers, staff and workers on site who are the ones that can make it succeed. Employees in oil palm plantations a lot of hard work on a daily basis, (especially the harvesters), and also isolation (Stuebing, 2010), that leaves little time and energy to participate in dedicated conservation management program. They really do count.

Furthermore, conservation is not merely a material commitment but requires daily discipline, as any successful outcome demands. REA Conservation has developed over more than a decade, admittedly with fits and starts. We hope that it will continue evolve in a successful way, from an empirically based suggestion, to a dedicated experiment, to a habit, and with some good luck eventually to become an entrenched to a tradition. And as we know with any successful industry, traditions are hard tobreak.

Finally, any company interested to have such a program must search for conservation staff with a science-based background and an enthusiasm for working in the field. A Conservation team once assembled, must be adequately funded, equipped provided with strong leadership and support from the top. It must always adhere to internationally recognized scientific standards and protocols, collect relevant field data on a daily basis, and use this data to construct – and use - a permanent database on the biological landscape. Because of the daunting workload in field research, the Department must attract, motivate and support collaboration local scientists and their students, as well as interested science-based conservation NGOs. The results of these studies will provide the staff an in-depth understanding conservation management required for natural areas under their watch (sometimes called “HCV”). They can then proceed with a well-documented, practical implementation of the control, increase, sustainably use or just keeping an eye on the species and habitats for which they are responsible. Finally and of paramount importance, invite, engage, inspire and join with local communities to participate in all matters concerning local conservation management. Publication of articles outlining the results in journals or the local and national media is a laudable goal, especially if a conservation community can become a permanent part of the plantation industry. REA KON is not the next BIG IDEA; just a classic idea that works. And it is not “Other”.

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APPLICATION OF GAMMA RAYS IRRADIATION TO GERMINATION AND GROWTH OF JAMBLANG SEEDLINGS (*Syzygium cumini*)

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Abstract

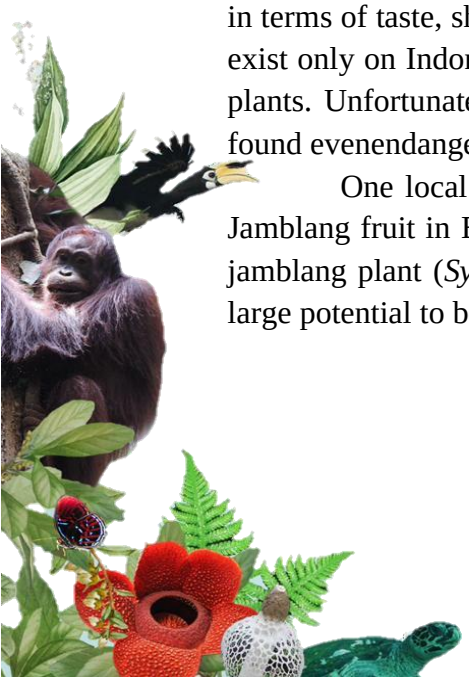
Indonesia is one of the countries with a great diversity of flora, especially local fruits. One of these biodiversity is Jamblang (*Syzygium cumini*). Jamblang contain an alkaloid, flavonoid, resin, tannin, and essential oils. Jamblang is currently rare. Although its uses are widely known, but there is still little information about the characters and response of jamblang plant growth. The research purposes is to study the germination and growth of jamblang seedlings grown on two types of media, after the seeds were irradiated with gamma rays. The experiment was designed using a factorial randomized split plot design. The main factor consists of media (husk charcoal and cocopeat) and subplot factor is the dose of gamma ray irradiation (0, 5, 10, 15, 20, 25, 30, 35, 40 and 45 Gy). The results showed that gamma rays irradiation gave a significant difference to the percentage of viability and growth rate of jamblang seeds also the height and diameter of the stems of jamblang seedlings. The treatment of husk charcoal media produced a better growth response to root length, leaf color, plant height and stem diameter. Whereas cocopeat media showed a better response to the number of leaves and the number of leaf stomata.

Keywords: Jamblang (Syzygium cumini), irradiation, germination, growth

I. INTRODUCTION

Indonesia has a rich biodiversity that is very potential to be developed on an industrial scale. However, a lot of biological wealth has not been explored and utilized to improve the welfare of the Indonesian people. One of Indonesia's biodiversity is fruit plants. The types of tropical fruits in Indonesia have a very high level of diversity both in terms of taste, shape, color and aroma, some of which are very unique and exotic that exist only on Indonesian earth so that it becomes a rich biodiversity of Indonesian fruit plants. Unfortunately now some of Indonesia's tropical fruits are starting to be rarely found evenendangered.

One local fruit that has prospects to be developed is jamblang or duwet fruit. Jamblang fruit in English is called by java plum, black plum, jambolan or jambul. The jamblang plant (*Syzygium cumini*) in Indonesia is currently one of the fruits with very large potential to be developed. Jamblang plants contain chemical compounds including



alkaloids, flavonoids, resins, tannins, and essential oils (Arifin, 2006). Although its uses are widely known, but there is still little information about the growth behavior of jamblang plants. Knowledge about the growth and development behavior of a type of plant is needed to know how to handle and maintain or cultivate this *Syzygium cumini*. Mudiana (2007) reports that the percentage of normal germination seeds is still very low at only 6.67%. This is supported by the research of Sudomo and Swestiani (2018) which says that the jamblang seed germination is relatively low at 70%.

Various ways can be done to increase the percentage of germination, one of which is by using gamma rays irradiation. According to Chan and Lam (2002) gamma rays can increase the percentage of germination compared to control. Gamma rays are also known to affect plant growth and development by inducing cytological, genetic, biochemical changes in tissue cells (Gunckel and Sparrow, 2001) and changing physiological characters (Kang et al., 2013). Some other factors that can influence seed germination and growth besides internal factors are external factors, namely the growing environment. Growing environment that is quite influential is the seedling media or germination media. Good germination media must have good physical properties, have the ability to absorb water, oxygen and free from disease-causing organisms (Sutopo,2000).

The purpose of this research was to study the application of various doses of gamma rays irradiation to germination and growth of jamblang seedlings in two types of media namely husk charcoal and cocopeat.

II. RESEARCH METHODS

A. Time and place

This research was conducted in April to September 2019. The research site was at the Green house of Universitas Nasional Laboratory Center, Jl. Bambu Kuning, Jatipadang, Pasar Minggu, South Jakarta.

B. Material reasearch

The ingredients used are seeds from jamblang fruit (*Syzygium cumini*) obtained from Tangerang Banten, husk charcoal and cocopeat, 70% alcohol and clear nail polish. The equipment used in this research is plastic, pot, treatment label, drill, measuring glass, pencil, pen, ruler, digital hygrometer, micrometer screw, masking tape, scissors, microscope, camera and Munsell plant tissue color book.

C. Procedures

1. Preparation of seed and germination

The source of the seeds comes from ripe fruit that has been blackish purple harvested from Babakan Asem Village, Tangerang Banten. Then the jamblang is

selected based on the skin color criteria. Seed extraction is done by removing the jamblang flesh manually using a knife to get the jamblang seeds, then washed and air dried for ± 5 days. Furthermore, jamblang seeds are selected based on the size of the seeds, which are 1.5 - 2 cm long which are then irradiated using gamma rays at the Testing Laboratory of the Application Center for Isotope and Radiation Technology of the National Nuclear Energy Agency (LPPATIR BATAN) derived from Gamma Cell - 220 irradiators. Irradiation dose Gamma rays used are 0 (control), 5 Gy, 10 Gy, 15 Gy, 20 Gy, 25 Gy, 30 Gy, 35 Gy, 40 Gy and 45 Gy. The germination media used were husk charcoal and cocopeat that had been sterilized before. Sterilization is done by steaming media that has been put in plastic for 1 hour after boiling water using a steaming pan.

1. Seed germination

The seeds are buried in the germination media with a depth of 0.5 cm then the seeds are closed thinly using the media. Each experimental unit consisted of 5 jamblang seeds. In the germination process, every day up to 50 HST media is drenched with water as much as 100 ml of water per 1 nursery bag and maintained so that no puddles occur.

2. Transplanting preparation

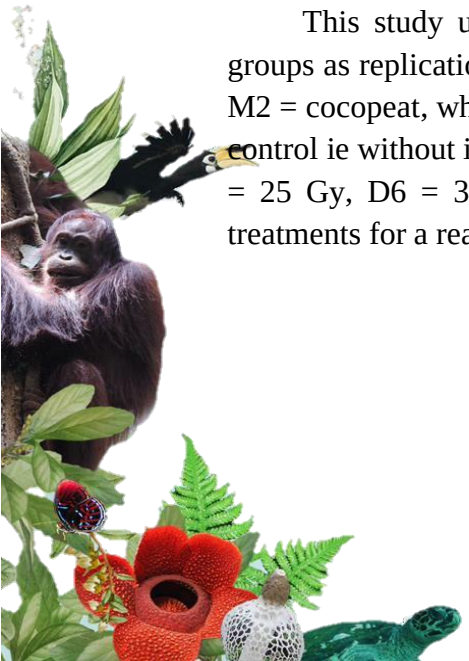
Jamblang plant seeds that have been aged 50 HST are then transplanted into pots according to the planting medium that has been prepared. The media used are the same media, namely husk charcoal and cocopeat as much as 300 grams per pot. The pot used is a pot with a diameter of 25 cm. Careful removal of plant seeds so as not to damage the roots. Seedlings that have been planted are then covered thinly usingmedia.

3. Cultivation Maintenance

Seedling maintenance includes weeding and fertilizing. Weeding is carried out every month to clean up growing weeds. Fertilization is done a week after transplanting, seedlings are fertilized with biofarm liquid organic fertilizer at a dose of 5 mL per liter of water. Fertilization is applied once a week to plants at a dose of 250 mL per seedling.

D, Research Design

This study used a randomized plot design with a split plot on 3 experimental groups as replications. As the main plot is media (M) namely : M1 = husk charcoal and M2 = cocopeat, while as a subplot is a dose of gamma rays irradiation (D) namely: D0 = control ie without irradiation, D1 = 5 Gray, D2 = 10 Gy , D3 = 15 Gy, D4 = 20 Gy, D5 = 25 Gy, D6 = 30 Gy, D7 = 35 Gy, D8 = 40 Gy, D9 = 45 Gy. Testing between treatments for a real influence using LSD 5%.



III. RESULTS ANDDISCUSSION

Jamblang Seed Germination

The germination process is the initial stage of the process of forming new individuals in seed plants. The jamblang germination was observed up to 50 days after the seeds were planted (HST). Measurements of the germination process includes the percentage of viability and germination rate.

1. Percentage of Viability

Variance analysis on the percentage of viability showed that the media had no significant effect on viability of germination, but the dose of gamma rays irradiation showed a significant effect.

Table 1. Percentage of Jamblang Seed Viability on Different Media and Irradiation Doses

		Viability (%)	
Media	husk charcoal	73.7	a
	Cocopeat	80.0	a
Dose (Gy)			
	0	90	a
	5	86.7	a
	10	86.7	a
	15	86.7	a
	20	80	ab
	25	76.7	b
	30	76.7	b
	35	76.7	b
	40	50	c
	45	58	bc

Note: The numbers followed by the same letter are not significantly different at the 5% level according to the LSD test

The above table shows that the dose of gamma irradiation 5, 10, 15, 20 Gy is not significantly different from the control. However, gamma ray irradiation doses of 25, 30 and 35, 40 and 45 Gy were significantly different compared to controls. At this dose the percentage of viability decreased significantly with control so that it can be explained that starting a dose of 25 Gy gamma ray irradiation has reduced the germination of jamblang seeds. This is different from Norwasiswi and Muhammad's research (2016) which says that the dose of gamma ray irradiation using a dose of 40 Gy increases seed germination in the guava plant (*Syzygiumsp*).

Irradiation with doses above 20 Gy has reduced the quality of the jamblang seed because the percentage of viability is less than 80%.. This condition is in accordance with research by Zanzibar et al. (2014) in Bramasto et al. (2016) that the dose of gamma ray irradiation in white jabon plants is effective to germination at doses of 15-20Gy.

2. Percentage of Germination Rate

In Table 2, cocopeat media produced a growth rate of 10.94 KN% / etmal and on husk charcoal media of 9.78 KN% / etmal. According to Sudomo and Swestiani (2018) jamblang seeds planted in a combination of soil + sand media with a preliminary treatment of coconut water immersion only produced a growth rate of 4.96 KN% / etmal.

In general, the germination rate of jamblang seeds which irradiated by gamma rays shows significant differences. Germination rate decreases with increasing dose of gamma rays irradiation. At a dose of 40 Gy produces the lowest germination rate of 6.74 KN% / Etmal but not significantly different with the 45 Gy dose which produces a growth rate of 7.04 KN% / Etmal.

Table 2. The Percentage of Germination rate Jamblang Seed on Different Media and Irradiation Doses

		Germination rate **(KN%/Etmal)**	
Media			
	Husk charcoal	9.78	a
	Cocopeat	10.94	a
Dose (Gy)			
	0	13.68	a
	5	13.16	ab
	10	11.77	b
	15	11.63	b
	20	11.59	b
	25	9.43	cd
	30	8.94	cd
	35	9.61	c
	40	6.74	d
	45	7.04	d

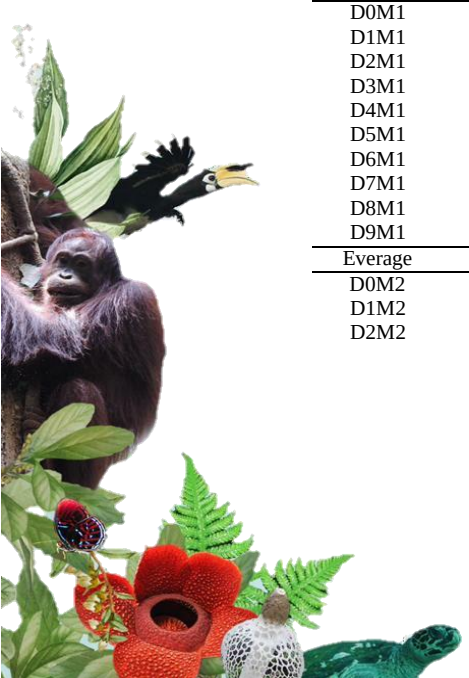
Note: The numbers followed by the same letter are not significantly different at the 5% level according to the LSD test

Jamblang Plant Seed characters at 50 HST

The characters observed were root length, stem length and leaf color. Data on observations of seedling characters are listed in Table 3.

Table 3. Root Length, Stem Length, Number of Branches and Leaf Color of Jamblang Seedlings Age 50 HST on Different Media and Doses of Irradiation

Treatments	Root Length (cm)	Stem Length (cm)	, Number of Branches	Leaf Color
D0M1	14.8	16.0	0	5 GY 4/8
D1M1	12.2	14.4	0	5 GY 4/8
D2M1	18.7	14.0	0	5 GY 4/8
D3M1	14.0	14.8	0	5 GY 4/6
D4M1	10.4	11.8	1	5 GY 5/6
D5M1	15.0	15.0	1	5 GY 4/8
D6M1	15.2	13.1	1	5 GY 4/6
D7M1	15.5	9.5	1	5 GY 4/8
D8M1	11.5	7.3	1	5 GY 5/6
D9M1	11.0	7.5	1	5 GY 4/8
Everage	13.8	12.3		
D0M2	12.4	16.7	0	5 GY 4/8
D1M2	13.4	15.3	0	5 GY 5/6
D2M2	12.2	12.1	1	5 GY 4/6



D3M2	11.5	14.9	0	5 GY 5/6
D4M2	14.2	13.1	1	5 GY 4/8
D5M2	13.6	10.0	1	5 GY 5/6
D6M2	12	13.0	1	5 GY 4/6
D7M2	12.5	11.5	1	5 GY 4/6
D8M2	10	13.0	1	5 GY 4/6
D9M2	10.2	6.5	1	5 GY 4/4
Everage	12.2	12.6		

Note: D = Gamma Rays Irradiation Dose, M = Media, D0 = Control, D1 =5 Gy, D2 = 10 Gy, D3 = 15 Gy, D4 = 20 Gy, D5 = 25 Gy, D6 = 30 Gy, D7 = 3Gy, D8=40 Gy, D9 = 45 Gy, M1 = Husk charcoal, M2 = Cocopeat

1. Root Length

The response to root length in each treatment showed differences. In the growing media, the husk charcoal has a longer root length than the cocopeat growing media. The average root length in the husk media was 13.8 cm while the cocopeat media was 12.2cm.

Root fibers in the husk charcoal media were also more numerous than cocopeat media (Figure 1). This is presumably because the husk charcoal has a high porosity which allows the roots to grow well. According to Kusuma et al. (2012) the factors that influence root growth are the presence of soil pore spaces.

Figure 1. Root Length of Jamblang Seedling at 50 HST on Various Media Left : Husk Charcoal, Right : Cocopeat

2. Length of the Stem

The results showed that the husk charcoal planting media tended to be significantly different from the cocopeat media. This might be due to the germination process not adding nutrients to the media so that stem growth is only influenced by food

reserves in the seeds. In the treatment of irradiation doses showed shorter stem lengths in line with increasing doses of gamma raysirradiation.

Gamma rays irradiation causes slower growth of seedlings than controls. This is presumably due to the higher dose of irradiation causing Jamblang seedlings to undergo genetic changes. This is in line with the research of Dewi and Dwimahyani (2013) on hibiscus flower plant that the treatment of gamma rays irradiation doses results in more stunted plants. Genetic changes are characterized by short appearance on plants.

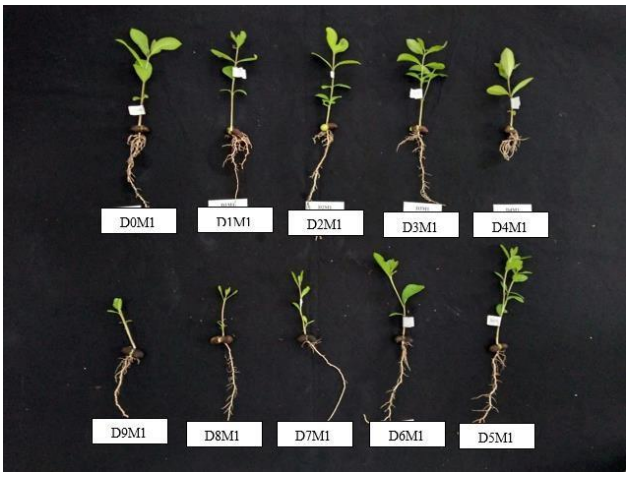


Figure 2. Stem Length of Jamblang Seedling at 50 HST

3. Number of Branches

Doses of gamma rays irradiation can increase the number of branches even if branching has occurred during the germination phase. This condition is very different from the control that does not produce branches at all (Figure 3 and 4).

Figure 3. Jamblang seedlings that do not have branches at the irradiation dose of 0 Gy

Figure 4. Jamblang seedlings that immediately appear branch at a 45 Gy irradiation dose

According to Dewi and Dwimahyani (2013) giving a dose of gamma rays irradiation can change the branching nature of plants. Furthermore, Hermawan (2018) said the increase in the number of branches due to gamma rays irradiation might be due to the chemical reaction process that causes physiological and biochemical changes in cells. The higher dose of gamma rays irradiation causes an increase in the number of branches of alfalfa plants (*Medicago sativa* L.) Gamma rays irradiation can modify very important components in plant cells and cause changes in part of the morphology, anatomy, biochemistry and physiology of plants depending on the level of radiation (Sutapa and Kasmawan, 2016).

4. Leaf Color

Measurement of leaf color using Munsell plant tissue color book to observe the color differences that occur in each treatment. Leaf color in cocopeat media tends to be more yellow than husk charcoal media.

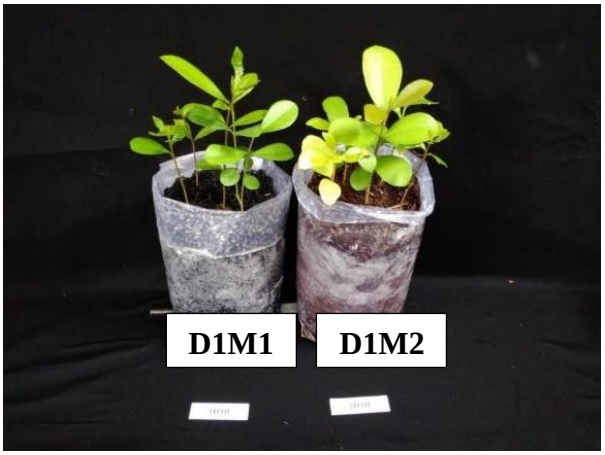


Figure 5. Different Leaf Colors in the Husk Charcoal and Cocopeat

Color differences in treatment with cocopeat media may be caused due to the presence of tannins contained in cocopeat media. This is in line with research by Sukarman et al. (2012) which states that tannins are mechanical barrier compounds in nutrient absorption.

Jamblang Seedling Growth

Jamblang seedlings that are 50 day after planting (HST) are then transplanted using the same media as in germination. Observation of the growth of jamblang seedlings was observed for 2 months by measuring plant height, number of leaves, stem diameter and stomata density of jamblang plants.

1. Height of Seedling

Analysis of variance showed that the dose factor of gamma rays irradiation significantly affected plant height. The influence of planting media and the dose of gamma ray radiation on the height of jamblang seedlings aged 2-8 week after transplanting (MSP) can be seen in Table 4.

Table 4. Effect of Media on Jamblang Seedling Height at 2, 4, 6 and 8 MSP

Height of Seedling (cm)								
		2 MSP		4 MSP		6 MSP		8MSP	
Media									
	Husk Carchoal	14.48	A	17.15	a	18.37	A	18.98	a
	Cocopeat	14.38	A	15.72	a	16.75	A	17.46	a
Dose (Gy)									
	0	17.03	Ab	18.68	ab	19.67	Ab	20.08	ab
	5	18.98	A	20.80	a	21.67	A	22.08	a
	10	15.42	B	18.18	b	18.43	B	18.52	Bc
	15	15.30	Bc	16.73	c	17.25	C	17.97	c
	20	13.83	C	15.42	d	16.13	Cd	16.98	de
	25	12.40	D	13.80	e	14.52	D	15.57	e
	30	13.52	Cd	16.15	cd	17.75	Bc	18.22	bc
	35	12.78	Cde	14.35	de	15.87	Cd	16.25	de
	40	12.87	Cde	15.72	cd	17.27	Bc	18.62	b
	45	12.15	E	14.50	de	17.05	Bc	17.90	d

Note: The numbers followed by the same letter are not significantly different at the 5% level according to the LSD test

The treatment of husk charcoal and cocopeat media did not show any significant difference in seedling height. However, jamblang seedling height on the husk charcoal media tends to be higher compared to cocopeat media. This is thought to be caused by the presence of tannins in cocopeat which causes slow growth of plant height.ThisissupportedbythestatementofSukarmanetal.(2012)thattreatmentof

plant height with the addition of cocopeat media results in a lower plant height compared to the husk charcoal media.

The treatment of gamma rays irradiation dose to the height of the jamblang seedlings resulted in a height that was significantly different from the control. The higher the dose given tends to reduce the height of the seedlings. However, at a dose of 5 Gy produces high seedlings that tend to be higher than the control. This is consistent with the study of Zanzibar and Witjaksono (2011) who reported that irradiation treatment of suren seeds irradiated by gamma rays at a dose of 5 Gy increased seedling growth compared to controls. However, gamma rays irradiation doses above 15 Gy have suppressed the growth of seedlingheight.

2. Number ofLeaves

Analysis of variance showed that planting media, irradiation dose and interaction of media with gamma rays irradiation dose did not significantly affect the number of leaves at 2, 4, 6 and 8 MSP (Figure 6).

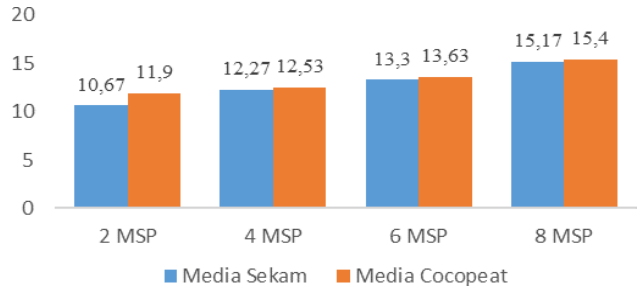


Figure 6. Graph of Jamblang Seedling Leaves in Different Media

The effect of gamma rays on jamblang seedling leaves at 2, 4, 6 and 8 MSP also showed no significant effect, but gamma rays irradiation tended to increase the number of leaves compared to control. The 15 Gy gamma ray irradiation dose showed the best number of leaves compared to all treatments (Figure 7). This is consistent with Hermawan (2018) said that the treatment of higher gamma rays irradiation doses increases the number of leaves of the alfalfa plant (*Medicago sativa*L.).

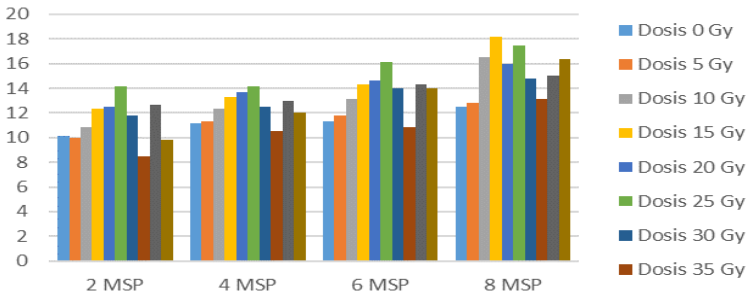


Figure 7. Graph of Jamblang Seedling Leaves in Different Irradiation Doses

3. Anatomy and Number of Stomata

The number of stomata in cocopeat media produced more stomata compared to the husk charcoal media (Figure 8).

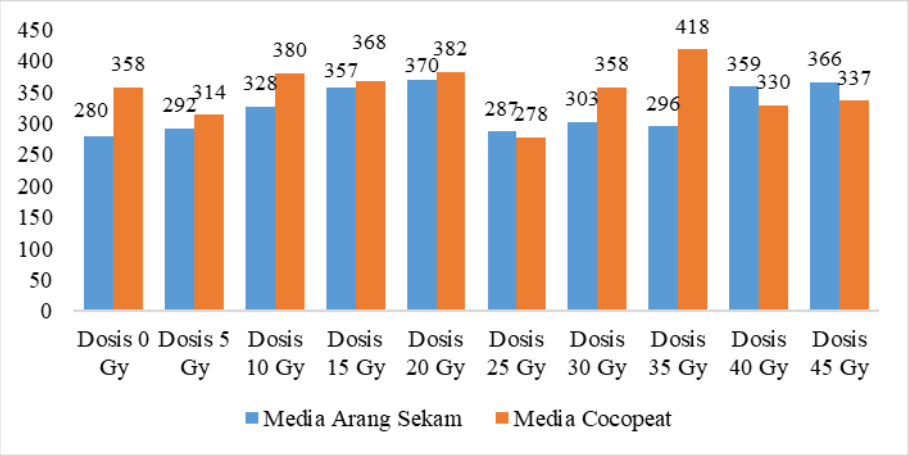


Figure 8. Diagram of Average Number of Stomata of Media Treatment Planting and Gamma Rays Irradiation

Doses of gamma rays irradiation showed no significant effect on the number of stomata. This is in accordance with research Norwasiswi and Surya (2016) which says that the treatment of gamma rays does not have a significant influence on the level of stomata density of the Papua Guava (*Syzygium sp*). The number of stomata varies not only between species but also between leaves of the same plant. Kimball (2006) in Sundari and Atmaja (2011) explained that the level of stomata density was influenced by environmental factors such as: temperature, light intensity, humidity and CO_2 concentration. The higher light intensity influences the increasing number of stomata. The large amount of stomata is the process of adaptation of plants to their environmentalconditions.

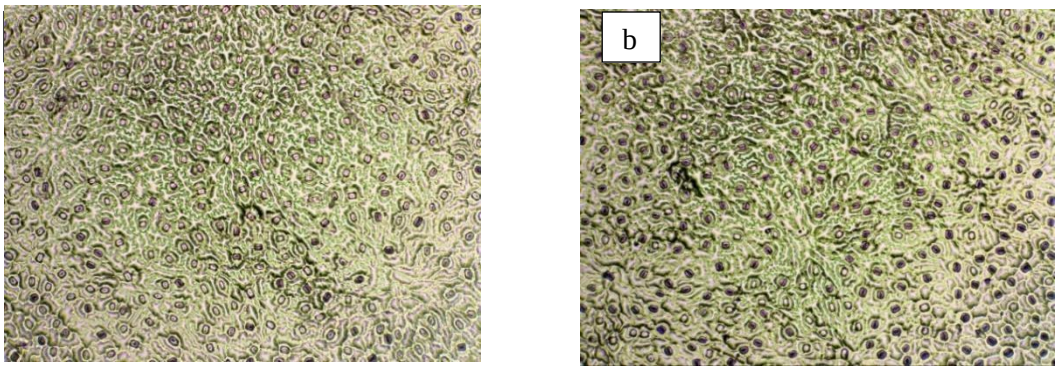


Figure 9. Stomata on Husk Carchoal Media (a) and Stomata on Cocopeat Media (b)

The low amount of stomata on the husk charcoal media might be due to the less amount of available water. Stomata on the husk charcoal media also tend to close compared to cocopeat media. This may be a form of adaptation to drought stress. According to Subantoro (2014) in Widianti et al. (2017) water stress causes a decrease in turgor in plant cells and results in decreased physiological processes. Physiologically, plants that grow in drought stress conditions will reduce the number of stomata thereby reducing the rate of water loss followed by stomatal closure. Furthermore, according to Sulistyono (2012) in Widianti et al. (2017) the first physiological process affected by drought stress is a decrease in leaf size which can cause a decrease in the number of stomata andphotosynthesis.

IV. CONCLUSIONS

1. Viability and germination rate of jamblang seed were not significantly different in the husk a charcoal nd cocopeat media, as well as the seed character. However, the husk charcoal media showed better results on root length, leaf color, plant height and stem diameter. Whereas cocopeat media showed better on the number of leaves and the number of leafstomata.
2. Different doses of irradiation gamma rays produce different viability and germination rate. Doses above 20 Gy show decreased viability and germination rate, shorter stem length and root length. But the character of the seedlings shows it has been branched since the beginning of germination. For seedlings aged 8 MSP, doses above 20 Gy also produce lower height and diameter of seedling but the number of leaves tends toincrease.
3. Interaction media with doses of gamma rays irradiation show no significant difference in germination or growth of jamblangseedlings.

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INVENTORY OF PLANTS AS A SOURCE OF BUTTERFLY FEED (*Lepidoptera*: *Papilionoidae*) IN THE VILLAGE OF LEGON PAKIS, UJUNG JAYA, PANDEGLANG, BANTEN

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Abstrak

Habitat kupu-kupu ditandai dengan tersedianya tumbuhan inang pakan larva yaitu tumbuhan tempat kupu-kupu meletakkan telur-telurnya serta tumbuhan bunga yang mengandung nektar sebagai sumber pakan bagi kupu-kupu. Peran penyerbuk seperti kupu-kupu sangat besar dalam melestarikan tumbuhan. Kupu-kupu mengisap madu pada bunga-bunga dan dengan tidak sengaja menyerbuki bunga tersebut sehingga akhirnya terjadi pembuahan. Hasil penyerbukan inilah yang mengakibatkan berlangsungnya kehidupan selanjutnya bagi tumbuhan. Tujuan penelitian yaitu menginventarisasi tumbuhan pakan kupu-kupu yang ada di Legon Pakis, Ujung Jaya Pandeglang, Banten. Metode yang dilakukan dengan eksplorasi mengikuti jalan desa yang biasa dilalui masyarakat dan jalan setapak sepanjang tepi pantai. Hasil yang didapat ada tujuh suku tumbuhan yang teridiri dari sepuluh jenis tumbuhan pakan kupu-kupu. Tumbuhan yang dijadikan preferensi oleh kupu-kupu paling banyak adalah *Lantana camara* yang mempunyai warna bunga kuning, orange, merah danungu.

I. INTRODUCTION

Indonesia is one country that is known for its rich diversity of flora and fauna. High diversity of flora and fauna, among others, is influenced by various factors that support the distribution of flora and fauna. Among them are high and low from sea level, soil type, forest type, climate, human influence, water condition andothers.

Everywhere in the world, different kinds of plants and animals live together. Plants and animals trade with each other. They trade for things they both need to stay alive.

Butterflies are interesting insects, have a variety of body colors and wings, and can be found everywhere. The larvae are clustered in a host plant and the transformation of their larvae into butterflies is very easily observed.

Butterflies an important role in maintaining biodiversity as a pollinator. Pollination that occurs in plants helps plant propagation naturally. If one or both of these components are missing, the butterfly cannot carry on with itslife.

The many flowers of various types of plants such as *Euphatorium inulifolium*¸ *Lantana camara, Stachytarpheta indica* and *Caessalpinia pulcherrima* are an attraction for butterflies to come and suck nectar. The colour, scent, nectar, and flower structure are important factors for pollinators in visiting a flower.

Seeing the fact that the condition of a village in Legon Pakis Ujung Jaya Pandeglang, Banten in particular there are still many vacant lands covered with shrubs, weeds and also plant species that are deliberately planted by their owners such as fruit and vegetable trees.

Until now there is no accurate data on the existence of butterflies in the village of Legon Pakis Ujung Jaya so that research needs to be done.

II. RESEARCH METHODS

Research sites

Data was collected in March - April 2018, in the Village of Legon Pakis, Ujung Jaya, Pandeglang, Banten. Identification of plant samples was carried out at the National University Faculty of Biology botany Laboratory. Data collection was carried out by means of exploration following the usual path traversed by local residents, located in the village of Legon Pakis in the Ujung JayaBanten.

III. RESULTS AND DISCUSSION

A. Results

The results of observations in the field found 10 species of plants that became butterfly feed plants. The 10 spcies of plants are included in the *Primulaceae* (one species); *Lythraceae* (one species); *Verbenaceae* (one species); *Asteraceae* (three species); *Verbenaceae* (two species), *Acanthaceae* (one species); *Rubiaceae* (one species); and *Labiatae* (one species). Plants that are a source of food there are 10 species of 7 family (Table1).

Table 1. Butterfly food plants

No.	Family	Amount	Species
1.	Primulaceae	1	*Aegeceras corniculata*
2.	Lythraceae	1	*Cuphea hyssopifolia*
3.	Verbenaceae	2	*Lantana camara*
			Stachytarpheta indica
4.	Acanthaceae	1	*Asystasia gangitica*
5.	Rubiaceae	1	*Ixora* sp.
6.	Labiatae	1	*Clerodendron paniculatum*
7.	Asteracea	3	*Ageratum conysoides*
			Wildenia biflora
			Mikania micranta

Discription of butterfly food plant. The species are arranged by species , then by family.

1. *Aegiceras corniculatum* (kacang-kacang)(*Primulaceae*)

This small trees, or evergreen trees, grows to abaout 5 meters maximum height. The leaves are alternately arranged, fleshy and leathery and tend to be covered in coating of salt solution, the salt being secreted by glands in the leafepidermis.

The inflorescence is axillary or terminal and consists of an umbel of 15-20 flowers. The flowers possess 5 white petals which are joined together at the base. The fruit is an elongated capsule which is into two ripening.crowned by the persistent sepals and contains 1 seed which is exposed when the fruit splits. The outer bark is gray to reddish brown, split, and has a number of lenticels.

2. *Ageratum conysoides* (babandotan)(*Asteraceae*)

This is herbaceous weed of waste grounds. This upright hairy varies 5 cm to 1 meter in height. This plant is common in waste grounds and as a garden weed.

The leaves are simple, oval in outline and their edges have shallow blunt teeth. Those on the lower part of the stem are opposites but alternately placed further up.

Flowers are small and are tightly packed into heads. The flower heads are carried in small bunches. Each head is cup-shaped, about 6 mm across. The tube-shaped disc florets grow slightly above the gren surrounding bracts. There are no ray florets. The corolla of the disc florets are white but the heads are often violet, the colour being given by the styles.

Fruits are small, black.feathery pappus. Each has a few greenish or white flattened scales with bristles.

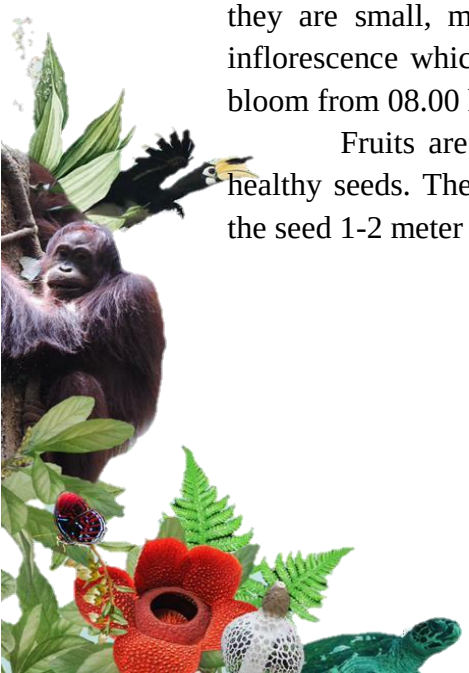
3. *Asystasia gangetica* (rumput israel)(*Acanthaceae*)

This weak-stemmed plant grows to about 50 cm tall and older plants often creep on the ground. Herbs, commonly found growing as weeds on openplaces.

Leaves usually in pairs and elliptical or oval in outline. They moderately large and heavy. Hence, taller plants frequently fall over and creep on the ground.

Flowers are creamy white, with a patch of attractive indigo-blue at the ‘tounge’ they are small, measuring only 1,5 cm across. Several flowers are borne on each inflorescence which is found at the end of the shoot. Usually, the flowers are in full bloom from 08.00 hours to 13.00 hours but by 16.00 hours they wither and drop off.

Fruits are club-shaped and are about 2 cm long. Each capsule contains four healthy seeds. The ripe capsules usually burst with considerable force, thus scattering the seed 1-2 meter away from the parent plant. The seeds are irregular inshape.



4. *Clerodenduom paniculatum* (bunga pagoda)(*Labiatae*)

Pagoda flowers are plants that we often encounter around us as ornamental plants. This pagoda flower plant has a beautiful red flower color, arranged like a pagoda.

Evergreen shrub to 1,5-3 meters tall. Leaves up to 30 cm long, opposite, subcordate to orbicular to ovate, 3-5 lobes.

Flowers are pink, orange-red or red, bisexual-shaped trumpet, in terminal, pagoda shape clusters. Fruits.

5. *Cuphea hyssopifolia* (*Lythraceae*) 0.5 – 1 cm across,globose

This is a small, hardy bush with small, purlish flowers borne long horizontal branches. Shrub, height 30-40 cm. Single flower, in the armpit of the leaf, the tube-shaped petals of the crown trumpet shape, smooth surface.

6. *Ixora* spp. (asoka)(*Rubiaceae*)

It is woody shrub, evergreen to treelet to 6 m tall, with simple leaves wich are arranged in pairs along twigs. The plant is commonly cultivated for their flowers.

Leaves 12-30 cm long, elliptic to oblred to purplish-black.ong, oppositely arranged. Flowers in many-flowered terminal clusters, 15-20 cm across, tubular. Fruits 7-12 mm across, globose ripening.

Asoka flower is one of the many flowers that grow in Indonesia as an ornamental plant. Asoka flowers will always bloom without knowing the season. crown shaped trumpet, orange, red, yellow , white and pink

7. *Lantana camara* (tembelekan) (*Verbenaceae*)

L. camara has become popular ornamental shrub. It emits a pungent smell from its simple leaves which are ovate with serrated edges. The flowers come in variety of colours like purple, yellow, white and pink.

Is an upright or half-vines shrubs with woody stems, many branches, height 0,5-4 m, has a distinctive odor. Generally grows as weeds in the open, edge of primary forest or planted as ornamental plants because of the beauty of the flowers.

Leaves are more or less oval in outline with pointed tips.They are rough and have toothed edges.

The flowers found in flat-topped bunches. The corolla is tube-shaped with 5 broad short lobes. These colours darken as the flower mature.

The fruits are small round berries also accur in clusters turning from green to dark blue.

8. *Mikania micranta*(*Asteracea*)

Mikania micranta, or often referred to as "vines," is an annual weed that grows quickly. This climbing plant has a slender stem which twines up any support. Mikania is included in important weeds in plantation areas and in open areas. This climber is common as a very fast growing weed in open places and the edge of the forest.

Leaves are triangular in shape with very slender leafstalks, green colours. Flowers are many and are tightly packed into heads. There are numerous flower-heads which are crowded at the ends of the inflorescence branches. Each flower head is about 6 mm long, surrounded by 4 oblong bracts. All flowers or florets are tube-shaped and scented. Flowers white and grow from the armpits of the leaves or at the tips of the shoots.

Fruits are angled. Each fruit has a ring of long, reddish bristles called pappus.

9. *Stachytarpetha indica* (pecut kuda)(*Verbenaceae*)

This bushy plant grow to 1 meter tall but it is often smaller. Leaves are small and opposite. They are usually elliptical in outline and have toothed edges. Flowers are found in long, narrow spikes. The corolla tube is pale blue some times is white or pink with 5 short deep blue lobes. There are 2 stamens inside the corolla tube.

Shrubs, mostly growing as weeds on open land, on plantations, on the roadside and on the beach, especially in the tropics. Is a herbaceous shrub that has a long life. Flowers are not stemmed so that the position sits directly on the axis shaped like a whip.

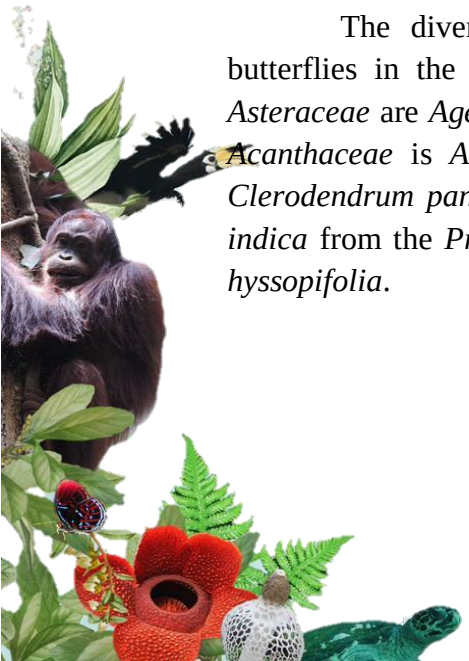
10. *Wildenia biflora* (seruni) (*Asteraceae*)

This is a sprawling herbs of sea coasts found in East Africa to the Pacific. This plant has horticultural potencial, with its hanging branches and pretty yellow flowers.

Herbaceous, this plant is often found on the shore, therefore called seruni beach. Compound interest with a cup-shaped wreath, has two types of flowers, namely ribbon flowers and tubular flowers. Calyc 5, cepals form a tube, a bright yellowcrown.

B. Discussion

The diversity of host plants as larvae feed determines the diversity of butterflies in the habitat (Soekardi, 2012). Plants that are butterfly feed from the *Asteraceae* are *Ageratum conyzoides*, *Wildenia biflora* and *Mikania micranta*, from the *Acanthaceae* is *Asystasia gingateca*, the *Rubiaceae* is *Ixora* spp., the *Labiatae* is *Clerodendrum paniculatum*, the *Verbenaceae* is *Lantana camara*, and *Stachytarpheta indica* from the *Primuliaceae* is *Aegeceras corniculata* and the *Lythraceae* is *Cuphea hyssopifolia*.



The plants that are preferred by butterflies are the flowering plants of *Lantana camara* which are the most visited by butterflies to suck nectar, with a frequency of 5 species of butterflies visiting the plant. The butterflies found in this flower are *Delias pasithoe, Junonia almana, J.altites, Eurema* spp, *Pachliopta aristolochiae,* and *Euplea mulciber.*

This is caused by the interesting color of *L. camara*, namely bright yellow, purple or orange and the presence of *L. camara* which is spread throughout the observation area. Because of the nature of its growth as a weed that is easily spread. Davies & Butler (2008) states that butterflies are more attracted to bright colors like yellow, white, red, orange, blue, and purple.

IV. CONCLUSION

Plants that are a source of food there are 10 species of 7 family. Almost all plants observed were adult butterfly food sources given the role of butterflies as pollinators and larval feed sources. The interaction of butterflies with plants can be in the form of, taking food in the form of nectar in flowers, perch and laying eggs on host plants. Plants that are used as preferences by butterflies the most butterfly is *Lantana camara.*

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FIELD RESISTANCE OF RICE GENETIC RESOURCES TO BLAST DISEASE (*Pyricularia grisea*)

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Abstract

Rice blast caused by the pathogenic fungus *Pyricularia grisea* is a major disease in upland rice plants in Indonesia. Yield losses due to blast related to planted varieties.The study aimed to examine of rice genetic resources resistance to blast disease (*Pyricularia grisea*). In this study, 100 rice accessions as parts of the BB Biogen Gene Bank collection were tested on farmers' land in Bojong Village, Cikembar District, Sukabumi Regency in the 2019 planting season. Seeds were planted directly without seedlings in the experimental plot. The experimental design was a randomized block design with 3 replications. Each accession was planted by 26 hills/plots (2 rows), with a row length of 2 meters, spacing of 15 cm x 25 cm, planted 5 grains of seed/ hill. Susceptible control of rice varieties Ciherang and Kencana Bali varieity namely, while Inpari Blas, Asahan, and Sianak Bogor variety as resistant control, which are planted of every between of 25 rice accessions. Fertilizers were applied according to local recommendations. The results showed that the reaction of rice accession to blast disease varied according to the level of resistance in its growth stages. Based on the observation at 5 weeks after planting, 21 accessions were highly resistant, 33 accessions were resistant, 33 accessions were moderately resistant, 12 accessions were moderately, and 1 accession was susceptible. At the observation 7 weeks after planting, 64 accessions were resistant, 30 accessions were moderately resistant, 5 accessions were moderately, and 1 accession was susceptible. In the observation of nect blast, 44 accessions were highly resistant, 23 accessions were resistant, 17 accessions were moderately resistant, 13 accessions were moderately, and 3 accessions were susceptible to blast disease. Resistant varieties could be used as breedingmaterials.

Keywords: Resistance, rice, Pyricularia grisea

I. INTRODUCTION

Germplasm is a genetic diversity that is owned by one plant species. The wide genetic diversity in germplasm provides a great opportunity for the improvement of plant genotypes (Sumarno, 2002). To dig up the information contained in the existing germplasm especially regarding the nature of its resistance to biotic and abiotic stresses it is necessary to evaluate it so that genotypes can be filtered that give positive responses to the effect of thestress.

Blast caused by the fungus *Pyricularia grisea* Cav. is a major disease of upland rice. This disease is distinguished based on the growth phase of the affected plant, which is an infection in the leaves causing leaf blasts, and infection in panicles causing neckblasts(SyamandHermanto,1995;MukelarandKardin,1991).Neckblastis

considered more dangerous because it can cause the void of seeds. Katsantonis et al. (2017) reported that the disesse can be severe during periods of cool temperatures and high moisture, while conidia do not germinate under direct sunlight (Ou, 1985). Moisture factor is very important for the onset of blast symptoms on the leaves and on the neck of the leaf. Loss of yield due to blast disease can reach 50-90% in susceptible varieties (Amir and Kardin, 1991). The upland rice blast resistance breeding program is a top priority in efforts to tackle blast disease. This study aims to evaluate the resistance of rice germplasm to blast disease (*Pyricularia grisea*) in the field. The results of research in the form of varieties/lines that are resistant to blast are expected to be used as the parent crossing in the breeding program of rice varieties resistant toblast.

The purpose of this study was to examine the resistance of 100 rice genetic resources to blast disease (*Pyriculariua grisea*) in the field.

II. RESEARCH METHODS

A. Studyarea

The study was in the form of evaluating the resistance of rice genetic resources to blast disease (*P. grisea*) conducted in the field to obtain a number of rice accessions resistant to blast disease.

B. Materialsresearch

A total of 100 accessions of rice obtained from the collection of BB Biogen Bank Gen, 2 susceptible comparison varieties (Kencana Bali, IR 64) and resistant comparators (Asahan, Sianak Bogor, Situpatenggang, Inpari Blas), sprayer holding, bucket, name tag, hand counter, ball point, and observation board.

C. Procedures

One hundred accessions of rice germplasm as parts of the BB Biogen Gene Bank collection were tested on farmers' land in Bojong Village, Cikembar District, Sukabumi Regency in the 2019 planting season. Rice seeds were planted directly without seedlings in upland conditions. The experimental design was a randomized block design with 3 replications. Each accession of rice is planted with 26 clumps/plots (2 rows), with a row length of 2 meters. Spacing of 15 cm x 25 cm, 5 grains / holes are planted. Plot area 2 meters x 0.5 meters. Susceptible comparators used are Kencana Bali and IR 64. Resistant comparators used are Asahan, Sianak Bogor, Situpatenggang, and Inpari Blas which are planted every 25 accessions of rice. Dose of fertilizer in accordance with local recommendations.

Plants are fertilized with 200 kg urea + 100 kg TSP + 100 kg KCl / ha, given in 3 stages. All TSP + KCl and 1/3 urea fertilizers are given at planting time. Then 1/3

doses of urea fertilizer each given at age 4 and 7 weeks after planting. Evaluation of resistance to leaf blast disease is carried out on plants aged 5 and 7 weeks after planting, and neck blasts after flowering plants (100 days). Scoring is carried out based on rice assessment standards (SES) (IRTP, 1988; Silitonga et al., 2003).

Table 1. Scale of rice genetic resources resistance against blast disease

Scale	Disease severity	Blast Reaction
0	No attack	Highly resistant
1	There are small brown spots the size of needles or larger without sporulation	Resistant
3	Brown spots are round to slightly oval (1-2 mm in diameter)	Moderately resistant
5	Ellipse wounds 1-2 mm long, 3 mm long with brown edges (attack 4-10% leaf area)	Moderately
7	Wide leaf margins, yellow or brown (attack 25-50% leaf area)	Susceptible
9	Very large injury, whitish gray color (attack 75% leafarea)	Highly susceptible

D. DataAnalysis

This descriptive data has not been statistically analyzed.

III. RESULTS AND DISCUSSION

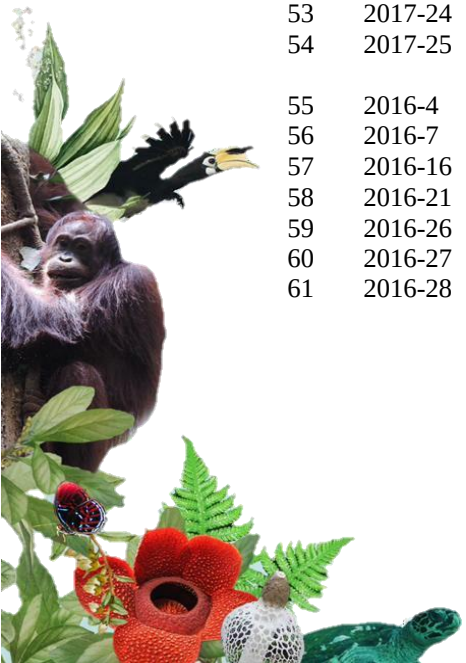
1. Observation 5 weeks afterplanting

The results showed that in the observation of blast disease 5 weeks after planting, it was found that there were a variety of reactions to the resistance of rice accession to leaf blast disease. At the observation of blast disease 5 weeks after planting, 21 accessions of highly resistant rice (HR), 33 accessions of rice resistant (R), 33 accessions of rice were moderately resistant (MR), 12 accessions of moderately rice (M), and 1 accession was susceptible (S) to leaf blast disease (Table2).

Tabel 2. Reaction resistance of rice genetic resources to leaf blast disease. Sukabumi, 2019 (5 weeks after planting)

No	Regstration	Accession name	Replication			Average	Resistance
			I	II	III		
1	2012-84	Ketan Sawo	7	7	5	6	M
2	2012-124	Mentik Sriwijaya	5	5	5	5	M
3	2012-126	Padi Merah	3	5	3	4	MR
4	2012-109	Ketek A	3	3	3	3	MR
5	2012-128	Padi Kurang Air	5	3	3	4	MR
6	2012-129	Padi Bintik	5	7	1	4	MR
7	2012-130	Padi Merah	1	3	3	2	R
8	2012-131	Padi Biji Besar	5	5	3	4	MR
9	2012-132	Padi Putih	5	5	5	5	M
10	2012-133	Padi Belong	5	3	3	4	M

11	2012-134	Padi Pulut Merah	5	7	3	5	M
12	2012-135	Padi Putih	5	5	3	4	MR
13	2012-136	Padi Merah	3	3	3	3	MR
14	2012-137	Wedah	1	1	1	1	R
15	2012-139	Bulu Kuning	1	1	3	2	R
16	2012-140	Bulu Hitam	0	0	1	0	HR
17	2012-141	Bulu Ungu	5	3	5	4	MR
18	2012-142	Gundil Bintik	3	3	3	3	MR
19	2012-144	Padi Unggul	5	5	3	4	MR
20	2012-148	Bulu Sumenep	9	7	7	8	S
21	2012-150	Padi Merah	5	3	5	4	MR
22	2012-114	Pulut	0	0	1	0	HR
23	2012-152	Padi Hitam/Bulu Celang	0	0	3	1	R
24	2012-153	Ketan Hitam	5	5	5	5	M
25	2012-116	Sendani 2	0	1	1	1	R
26	2012-143	Pulut Merah	3	3	1	2	R
27	2012-145	-	5	5	3	4	MR
28	2012-155	Pondong	3	3	1	2	R
29	2012-156	Tongbulan	3	3	3	3	MR
30	2012-157	Merah	5	1	3	3	MR
31	2012-158	Padi Putih	5	5	5	5	M
32	2012-159	Renggerengan	1	1	0	1	R
33	2012-160	Bulu Putih	5	5	5	5	M
34	2012-161	Bulu Merah	3	3	3	3	MR
35	2012-162	-	5	5	3	4	MR
36	2012-165	Segreng	3	3	5	4	MR
37	2012-174	Cempo Hitam Genjah	1	3	1	2	R
38	2013-146	Marahmay Merah A	1	1	1	1	R
39	2016-282	Pandan wangi	3	3	3	3	MR
40	2016-401	Bolu Kompa	5	5	5	5	M
41	2013-162	Sari Kuning	0	0	0	0	HR
42	2016-403	Lokal Wajo	3	5	5	4	MR
43	2014-2	Badigal	3	1	3	2	R
44	2017-7	Sitamba	0	0	1	0	HR
45	2017-8	Sodori	0	0	1	0	HR
46	2015-12	Gunang	0	0	1	0	HR
47	2017-9	Sigombol	0	0	0	0	HR
48	2017-19	Condong Merah	1	0	3	1	R
49	2017-24	Sigambiri Merah	3	3	3	3	MR
50	2017-37	Biji Limau	0	0	1	0	HR
51	2017-41	Bereh Kuning	1	1	1	1	R
52	2017-23	Sirambat	3	3	3	3	MR
53	2017-24	Sigambiri Merah	0	0	1	0	HR
54	2017-25	Sirapat	0	0	1	0	HR
55	2016-4	Pare Tumbu Padang	3	1	3	2	R
56	2016-7	Pare Panda	1	0	0	0	HR
57	2016-16	Pare Barana	0	1	1	1	R
58	2016-21	Pare Jawa	1	1	1	1	R
59	2016-26	Pare Patti	0	0	1	0	HR
60	2016-27	Pare Batu Batu	0	0	0	0	HR
61	2016-28	Pare Kemenyam	1	0	1	1	R



62	2017-31	Sigabe raya	0	0	1	0	HR
63	2017-38	Penuh Baru	0	0	0	0	HR
64	2016-31	Pare Bae Merah	0	0	1	0	HR
65	2016-32	Pare Belanda	0	0	3	1	R
66	2016-34	Pare Tabu	0	0	0	0	HR
67	2016-36	Pare Bulanan	0	1	1	1	R
68	2016-45	Siangkat	3	3	3	3	MR
69	2016-68	Malaysia Wangi	0	0	1	0	HR
70	2016-69	Padi Telor	1	0	1	1	R
71	2016-70	Padi Telor (coklat)	3	5	3	4	MR
72	2016-72	Padi Induk	3	1	0	1	R
73	2017-41	Sipenuh Lama	1	0	1	1	R
74	2017-132	Woja Rakot	5	5	5	5	M
75	2017-139	Lea	3	3	3	3	MR
76	2017-140	Woja Bogor	3	3	3	3	MR
77	2016-80	Padi Kecik 25	3	5	3	4	MR
78	2017-141	Kartuna	3	1	3	2	R
79	2017-143	Laka	0	3	1	1	R
80	2017-146	Kosu Ampera	3	3	3	3	MR
81	2017-147	Kosu Mite	1	0	0	0	HR
82	2016-86	Padi Kecik 9	3	1	3	2	R
83	2017-147	Kosu Mite	5	5	5	5	M
84	2016-88	Padi Kecik 11	1	0	0	0	HR
85	2017-151	Toro	3	3	3	3	MR
86	2016-91	Padi Kecik 14	3	1	3	2	R
87	2017-153	Woja Raja Rakot	3	5	5	4	MR
88	2016-93	Kecik 16	3	0	3	2	R
89	2016-94	Padi Kecik 25	3	3	5	4	MR
90	2016-154	Woja Raja Rakot	7	5	5	6	M
91	2016-156	Roslin Merah	3	3	5	4	MR
92	2016-99	Padi Putih 2	1	0	3	1	R
93	5656b	Mendura-9	3	0	1	1	R
94	2016-66	Serayu-1	0	0	0	0	HR
95		Dupa	3	1	1	2	R
96		Swarnalata	7	3	1	4	MR
97	4082	Randah Sasak	3	1	0	1	R
98	12353	Jarab	1	0	1	1	R
99	20081	Cingir Putri	3	3	3	3	MR
100	4117	Siak Simpur	3	1	3	2	R

2. Observation 7 weeks after planting

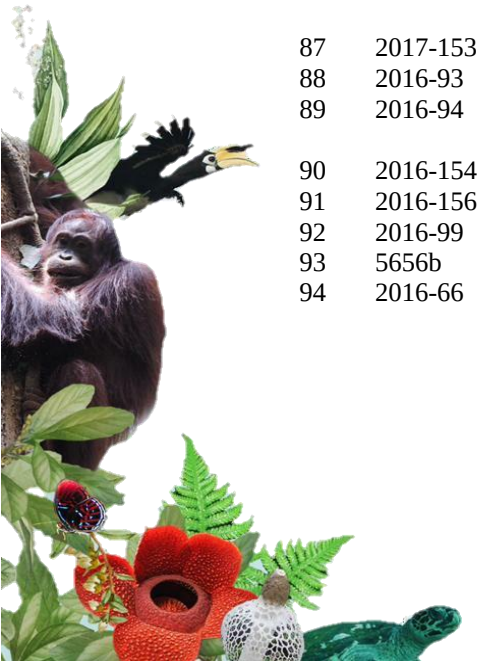
The results showed that the observation of blast disease 7 weeks after planting, there was a diversity of resistance of rice accessions to leaf blast disease. At the observation of blast disease 7 weeks after planting, 64 accessions of resistant rice (R), 30 accessions of moderately resistant rice (MR), 5 accessions reacted moderately (M), and 1 accession reacted susceptible (S) to leaf blast disease (Table3).

In India, Turaidar et al. (2018) reported that the accessions of Baigan Munji and Adri Batta were shown moderately resistant and Tetep shown resistant reaction againstblast.

Table 3. Resistance of rice genetic resources to leaf blast disease. Sukabumi, 2019. (7 weeks after planting)

No.	Registration	Accession name	Replication I	II	III	Average	Resistance
1	2012-84	Ketan Sawo Mentik	5	7	1	4	MR
2	2012-124	Sriwijaya	5	3	1	3	MR
3	2012-126	Padi Merah	3	1	3	2	R
4	2012-109	Ketek A	3	3	1	2	R
5	2012-128	Padi Kurang Air	7	3	3	4	MR
6	2012-129	Padi Bintik	5	7	1	4	MR
7	2012-130	Padi Merah	3	1	1	2	R
8	2012-131	Padi Biji Besar	7	7	1	5	M
9	2012-132	Padi Putih	5	3	3	4	MR
10	2012-133	Padi Belong	5	3	3	4	MR
11	2012-134	Padi Pulut Merah	3	9	1	4	MR
12	2012-135	Padi Putih	3	5	1	3	MR
13	2012-136	Padi Merah	1	5	3	3	MR
14	2012-137	Wedah	1	1	1	1	R
15	2012-139	Bulu Kuning	1	1	1	1	R
16	2012-140	Bulu Hitam	1	1	1	1	R
17	2012-141	Bulu Ungu	3	5	3	4	MR
18	2012-142	Gundil Bintik	0	0	3	1	R
19	2012-144	Padi Unggul	3	5	3	4	MR
20	2012-148	Bulu Sumenep	9	9	7	8	S
21	2012-150	Padi Merah	9	3	3	5	M
22	2012-114	Pulut	0	3	3	2	R
23	2012-152	Padi Hitam/ Bulu Celang	1	1	1	1	R
24	2012-153	Ketan Hitam	3	5	1	3	MR
25	2012-116	Sendani 2	0	3	1	1	R
26	2012-143	Pulut Merah	1	1	3	2	R
27	2012-145	-	1	3	1	2	R
28	2012-155	Pondong	5	5	1	4	MR
29	2012-156	Tongbulan	3	3	1	2	R
30	2012-157	Merah	1	3	1	2	R
31	2012-158	Padi Putih	5	5	1	4	MR
32	2012-159	Renggerengan	1	1	1	1	R
33	2012-160	Bulu Putih	5	7	1	4	MR
34	2012-161	Bulu Merah	3	5	1	3	MR
35	2012-162	-	7	9	1	6	M
36	2012-165	Segreng	3	3	1	2	R
37	2012-174	Cempo Hitam Genjah	1	1	1	1	R
38	2013-146	Marahmay Merah A	1	3	1	2	R
39	2016-282	Pandan wangi	3	3	1	2	R
40	2016-401	Bolu Kompa	5	5	1	4	M
41	2013-162	Sari Kuning	1	1	1	1	R
42	2016-403	Lokal Wajo	3	5	1	3	MR
43	2014-2	Badigal	1	3	1	2	R
44	2017-7	Sitamba	1	1	1	1	R
45	2017-8	Sodori	1	1	1	1	R

46	2015-12	Gunang	1	1	1	1	R
47	2017-9	Sigombol	0	1	1	1	R
48	2017-19	Condong Merah	1	3	1	2	R
49	2017-24	Sigambiri Merah	3	1	1	2	R
50	2017-37	Biji Limau	3	1	1	2	R
51	2017-41	Bereh Kuning	1	3	3	2	R
52	2017-23	Sirambat	3	3	1	2	R
53	2017-24	Sigambiri Merah	3	1	5	3	MR
54	2017-25	Sirapat	1	3	1	2	R
55	2016-4	Pare Tumbu Padang	3	1	1	2	R
56	2016-7	Pare Panda	3	3	1	2	R
57	2016-16	Pare Barana	0	1	1	1	R
58	2016-21	Pare Jawa	1	1	1	1	R
59	2016-26	Pare Patti	1	1	1	1	R
60	2016-27	Pare Batu Batu	1	1	1	1	R
61	2016-28	Pare Kemenyam	1	1	3	2	R
62	2017-31	Sigabe raya	3	1	1	2	R
63	2017-38	Penuh Baru	1	1	3	2	R
64	2016-31	Pare Bae Merah	1	1	1	1	R
65	2016-32	Pare Belanda	1	3	1	2	R
66	2016-34	Pare Tabu	1	1	3	2	R
67	2016-36	Pare Bulanan	3	1	1	2	R
68	2016-45	Siangkat	3	1	1	2	R
69	2016-68	Malaysia Wangi	1	1	1	1	R
70	2016-69	Padi Telor	3	1	3	2	R
71	2016-70	Padi Telor (coklat)	3	5	1	3	MR
72	2016-72	Padi Induk	1	0	3	1	R
73	2017-41	Sipenuh Lama	1	3	1	2	R
74	2017-132	Woja Rakot	5	5	1	4	MR
75	2017-139	Lea	1	5	3	3	MR
76	2017-140	Woja Bogor	1	1	3	2	R
77	2016-80	Padi Kecik 25	1	3	3	2	R
78	2017-141	Kartuna	1	3	1	2	R
79	2017-143	Laka	0	3	3	2	R
80	2017-146	Kosu Ampera	1	1	3	2	R
81	2017-147	Kosu Mite	3	3	3	3	MR
82	2016-86	Padi Kecik 9	3	1	3	2	R
83	2017-147	Kosu Mite	3	5	1	3	MR
84	2016-88	Padi Kecik 11	1	1	3	2	R
85	2017-151	Toro	3	3	3	3	MR
86	2016-91	Padi Kecik 14	1	3	3	2	R
87	2017-153	Woja Raja Rakot	3	3	3	3	MR
88	2016-93	Kecik 16	1	1	3	2	R
89	2016-94	Padi Kecik 25	1	3	1	2	R
90	2016-154	Woja Raja Rakot	7	5	3	5	M
91	2016-156	Roslin Merah	3	5	1	3	MR
92	2016-99	Padi Putih 2	3	3	3	3	MR
93	5656b	Mendura-9	3	3	1	2	R
94	2016-66	Serayu-1	1	1	1	1	R



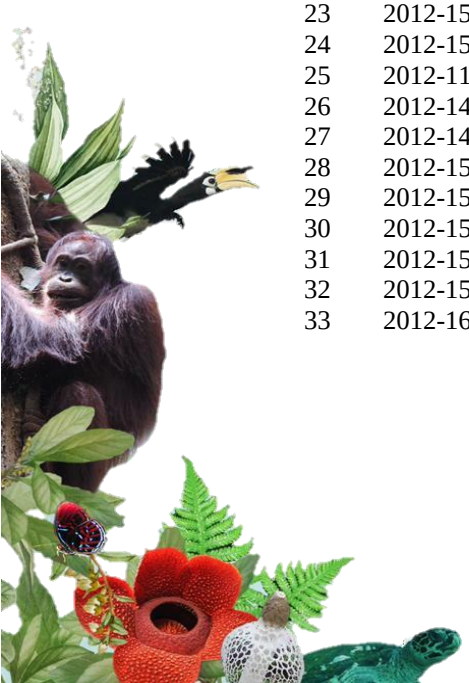
95		Dupa	3	1	1	2	R
96		Swarnalata	9	5	1	5	M
97	4082	Randah Sasak	3	1	1	2	R
98	12353	Jarab	3	3	1	2	R
99	20081	Cingir Putri	5	5	3	4	MR
100	4117	Siak Simpur	3	3	3	3	MR

3. Observation of panicle neck stage

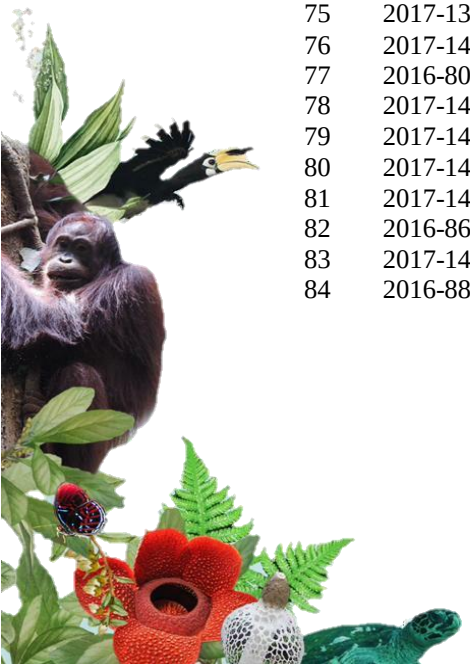
The results showed that in the observation of panicle stadia, it was found that there was a diversity of resistance reactions in rice access to panicle blast disease. In the observation of panicle stadia blast disease; there were 26 accessions of moderately resistant rice (MR), 102 moderately accessions (M), and 22 rice accessions susceptible (S) to panicle neck disease (Table 4).

Table 4. Resistance of rice genetic resources to panicle nect blast. Sukabumi, 2019

No.	Registration	Accesssion name	Replication			Average	Resistance
			I	II	III		
1	2012-84	Ketan Sawo	3	5	7	5	M
2	2012-124	Mentik Sriwijaya	1	4	5	3	MR
3	2012-126	Padi Merah	3	4	5	4	MR
4	2012-109	Ketek A	0	0	0	0	HR
5	2012-128	Padi Kurang Air	9	7	5	7	S
6	2012-129	Padi Bintik	1	5	5	4	MR
7	2012-130	Padi Merah	-	1	1	1	R
8	2012-131	Padi Biji Besar	7	7	4	6	M
9	2012-132	Padi Putih	5	7	6	6	M
10	2012-133	Padi Belong	5	6	6	6	M
11	2012-134	Padi Pulut Merah	5	7	5	6	M
12	2012-135	Padi Putih	3	5	3	4	MR
13	2012-136	Padi Merah	1	7	6	5	M
14	2012-137	Wedah	0	0	3	1	R
15	2012-139	Bulu Kuning	1	3	5	3	MR
16	2012-140	Bulu Hitam	0	0	0	0	HR
17	2012-141	Bulu Ungu	3	5	6	5	M
18	2012-142	Gundil Bintik	1	1	3	2	R
19	2012-144	Padi Unggul	1	1	5	2	R
20	2012-148	Bulu Sumenep	9	9	7	8	S
21	2012-150	Padi Merah	5	7	7	6	M
22	2012-114	Pulut	0	0	1	0	HR
23	2012-152	Padi Hitam/Bulu Celang	0	0	0	0	HR
24	2012-153	Ketan Hitam	1	5	3	3	MR
25	2012-116	Sendani 2	0	1	0	0	HR
26	2012-143	Pulut Merah	3	1	3	2	R
27	2012-145	-	0	1	0	0	HR
28	2012-155	Pondong	5	7	5	6	M
29	2012-156	Tongbulan	1	5	5	4	MR
30	2012-157	Merah	3	3	3	3	MR
31	2012-158	Padi Putih	3	3	3	3	MR
32	2012-159	Renggerengan	0	1	1	1	R
33	2012-160	Bulu Putih	3	5	4	4	MR



34	2012-161	Bulu Merah	3	7	5	5	M
35	2012-162		9	7	5	7	S
36	2012-165	Segreng	3	3	3	3	MR
37	2012-174	Cempo Hitam Genjah	0	0	0	0	HR
38	2013-146	Marahmay Merah A	0	0	0	0	HR
39	2016-282	Pandan wangi	1	3	1	2	R
40	2016-401	Bolu Kompa	5	5	5	5	M
41	2013-162	Sari Kuning	0	0	0	0	HR
42	2016-403	Lokal Wajo	3	5	5	4	MR
43	2014-2	Badigal	1	5	4	3	MR
44	2017-7	Sitamba	0	0	1	0	HR
45	2017-8	Sodori	1	0	0	0	HR
46	2015-12	Gunang	0	0	1	0	HR
47	2017-9	Sigombol	0	0	0	0	HR
48	2017-19	Condong Merah	1	1	1	1	R
49	2017-24	Sigambiri Merah	0	0	0	0	HR
50	2017-37	Biji Limau	0	0	0	0	HR
51	2017-41	Bereh Kuning	0	0	0	0	HR
52	2017-23	Sirambat	1	3	1	2	R
53	2017-24	Sigambiri Merah	0	0	0	0	HR
54	2017-25	Sirapat	3	0	0	1	R
55	2016-4	Pare Tumbu Padang	0	0	0	0	HR
56	2016-7	Pare Panda	1	1	0	1	R
57	2016-16	Pare Barana	0	0	0	0	HR
58	2016-21	Pare Jawa	0	0	0	0	HR
59	2016-26	Pare Patti	0	0	0	0	HR
60	2016-27	Pare Batu Batu	0	0	0	0	HR
61	2016-28	Pare Kemenyam	0	1	0	0	HR
62	2017-31	Sigabe raya	1	3	1	2	R
63	2017-38	Penuh Baru	0	1	1	1	R
64	2016-31	Pare Bae Merah	0	0	0	0	HR
65	2016-32	Pare Belanda	1	0	0	0	HR
66	2016-34	Pare Tabu	0	0	0	0	HR
67	2016-36	Pare Bulanan	0	0	0	0	HR
68	2016-45	Siangkat	0	0	0	0	HR
69	2016-68	Malaysia Wangi	0	0	0	0	HR
70	2016-69	Padi Telor	0	0	0	0	HR
71	2016-70	Padi Telor (coklat)	0	0	0	0	HR
72	2016-72	Padi Induk	0	0	0	0	HR
73	2017-41	Sipenuh Lama	0	1	1	1	R
74	2017-132	Woja Rakot	3	3	3	3	MR
75	2017-139	Lea	0	1	5	2	R
76	2017-140	Woja Bogor	1	1	1	1	R
77	2016-80	Padi Kecik 25	0	1	4	2	R
78	2017-141	Kartuna	0	0	0	0	HR
79	2017-143	Laka	1	5	4	3	MR
80	2017-146	Kosu Ampera	0	3	1	1	R
81	2017-147	Kosu Mite	0	0	1	0	HR
82	2016-86	Padi Kecik 9	3	4	0	2	R
83	2017-147	Kosu Mite	3	5	1	3	MR
84	2016-88	Padi Kecik 11	0	0	0	0	HR



85	2017-151	Toro	1	1	1	1	R
86	2016-91	Padi Kecik 14	0	0	5	2	R
87	2017-153	Woja Raja Rakot	0	0	1	0	HR
88	2016-93	Kecik 16	0	0	0	0	HR
89	2016-94	Padi Kecik 25	0	0	0	0	HR
90	2016-154	Woja Raja Rakot	5	6	5	5	M
91	2016-156	Roslin Merah	3	7	3	4	HR
92	2016-99	Padi Putih 2	0	0	0	0	HR
93	5656b	Mendura-9	0	0	0	0	HR
94	2016-66	Serayu-1	0	-	0	0	HR
95		Dupa	o	1	0	1	R
96		Swarnalata	9	3	4	5	M
97	4082	Randah Sasak	1	0	0	0	HR
98	12353	Jarab	1	1	1	1	R
99	20081	Cingir Putri	5	4	4	4	M
100	4117	Siak Simpur	0	1	0	0	HR

Yualiani et al.(2014) stated that alternative to control blast disease including appropriate planting time, varieties rotation based on resistance gene, seed treatment, fertilizer, and chemical control. Therfore, the recommended control is integrated manner by combining a variety of ways that can suppress the development of blast disease in thefield.

IV. CONCLUSIONS AND RECOMMENDATION

A. Conclusions

1. On observing blast disease 5 weeks after planting, 21 accessions of rice were obtained highly resistant, 33 accessions of rice resistant, 33 accessions of rice moderately resistant, 12 accessions of rice moderately, and 1 accesion of rice susceptible to disease leafblast.
2. On observing blast disease 7 weeks after planting, 64 accessions of resistant rice were obtained, 30 accessions were moderately resistant, 5 accessions reacted moderately, and 1 accession was susceptible to leafblast.
3. On observation of stadia blast disease out of panicle, 44 accessions of rice were highly resistant, 23 accessions were resistant, 17 accessions were moderately resistant, 13 accessions were moderately, and 3 accessions were susceptible to nectblast.

B. Recommendation

Resistant accessions could be considered as breeding materials for developing blast resistant variety.

ACKNOWLEDGEMENTS

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BIODIVERSITY OF PLANKTON AND THE RELATION WITH ORGANIC SOLVENT CONTENT IN AGUNG SUNTER LAKE, NORTH JAKARTA

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Abstract

Water is the absolute need for human and the other living things, indeed. That goes for a daily life, water is needed for any activities inside the household, agriculture, transportation, recreation, and industry. This research intended to provide comprehension to public about the sustainable water preservation so it could reduce pressure against biotic and abiotic pollution around the Sunter Agung lake area. The method used in this research is field survey method, while the sampling technique used in this research is purposive sampling technique. This water quality analysis was done to see the relation between plankton diversity and dissolved organic matter content in water. Plankton sampling was taken by plankton net and total organic matter test with permanganate solution by taking a few water sample to be tested at Universitas Nasional laboratory. Research result represent that plankton identification was dominated by *Synedra* sp. and *Characium* sp. with a low diversity level. The result of permanganate test obtained that the value of total organic matter of Sunter Agung lake is around 35 – 40 mg/L. This result shows that there has been a decrease of water quality in Sunter Agung lake and this lake can be categorized as mildly polluted lake. Even so, there are still a number of water organisms that could live in thelake.

Keywords: diversity, lake, permanganate, plankton,water

I. INTRODUCTION

Water is an essential component for all the needs of living things. Water is useful in various activities such as, household activities, agriculture, transportation, recreation, and industrial activities. Aquatic ecosystems are divided into two namely stationary waters (lentic) and flowing waters (lotic). One example of stationary aquatic ecosystems is lakes. Lake is one of freshwater ecosystems that water flow is calm (lentic), accumulating in one area. Lakes always receive water input from the catchment area around the lake, so lakes tend to receive dissolved materials that are transported together with incoming water. The quality of lake is highly dependent on the management of Daerah Aliran Sungai (DAS) that are controlling the water condition.

Beside useful for human living, lakes also become habitat for aquatic biota which are fishes, planktons, aquatic plants and more. The decrease of the quality of lake water can cause disruption to aquatic biota life in particular plankton. Plankton plays an

essential role in a waters. Plankton has an ecological function as a primary producer and beginning of a chain in the food web, so plankton is often used as a scale measurement of water fertility (Sachlan, 1982).

Plankton is a tiny organism that lives hovering following the movement of water. Plankton consists of phytoplankton and zooplankton. Phytoplankton are plant-like plankton that are free to float and drift in water and are able to photosynthesize. Zooplankton are tiny organisms that live hovering following the movement of water and considered as animal-like plankton.

Phytoplankton is the main supplier of dissolved oxygen in the waters, while zooplankton, as a direct beneficiary of phytoplankton, are secondary producers of water (Nybakken, 2012).

Community activities such as restaurants and water skiing around Lake Agung Sunter, North Jakarta, have had a major impact on changes in the quality of Lake Agung Sunter water. The presence of plankton in a waters can be a bioindicator of water quality. The purpose of this study was to reveal the diversity of plankton and the relation to dissolved organic content in Lake AgungSunter.

II. RESEARCH METHODS

Time and Place of Research

This research was conducted on 25 February 2019, 14 April 2019, 20 July 2019, and 23 August 2019 at Danau Agung Sunter, North Jakarta. Plankton identification was carried out at the National University's Botany Laboratory, Jalan Bambu Kuning, South Jakarta. The permanganate value analysis was carried out at the National University Chemical Laboratory, Jalan Bambu Kuning, SouthJakarta.

Tools and Materials

The tools that used in this research are as follows: plankton net, speed boat, 100 mL vial bottle, plankton identification book, microscope, object glass, cover glass and drop pipette. The materials that used in this research are as follows: $KMNO_4$ 0.01 N, H_2SO_4 8 N, $(COOH)_2$ 0.01 N, formalin 1%, and distilledwater.

Determination of Research Station

Plankton sampling was carried out in the middle of Lake Agung Sunter with horizontal sampling techniques and data collection of permanganate values was carried out at 7 stations on Lake Agung Sunter (Figure 1). Determination of the sampling point is based on the geographic location of Lake Agung Sunter, which represents Lake Agung Sunter as a whole. Plankton sampling is carried out in the morning and afternoon. Plankton was taken by plankton net that pulled horizontally by speedboat

with constant speed and repeated 2 times. Futhermore, the water that collected in plankton net and 12 mL water were added into vial bottle that labelled according to the time of taking the sample. The sample was then dropped with 1% formalin as much as 2-3 drops, and close the vial bottle tightly so it does not spill.

Figure 1. Location of research and the point of the stations for data collection

Water sampling was carried out to see the organic chemical content in the waters using permanganometry methods and was carried out at the National University Chemical Laboratory. Water samples were taken in 7 points with 2 repetitions. Samples were collected in 600 mL bottled mineral water. The test uses permanganometry principle which is the number of mg $KmnO_4$ needed to oxidize organic substances contained in a one liter sample of water with boiling for 10 minutes. Organic matter in water is determined as a permanganate number (Yusrin, 2008).

Data Analysis

Plankton Diversity

This research is used to determine the diversity of plankton species in an aquatic habitat. In the calculation of species diversity index values determined by the Shannon-Weaner index with the following equation (Odum, 1971):

$$H' = -\sum pi \ln pi$$

$$Pi = \frac{ni}{N} = ni/N$$

H '= Index of Species Diversity
Pi = Proportion of i-th importance
Ln = natural logarithm
ni = Number of individuals in the i-th type
N = Number of individuals of all types

The Shannon-Weaner diversity index range is as follows (Odum, 1971):
H 'value <1: Low diversity, high ecological pressure
Value 1 <H '<3: Medium diversity, moderate ecological pressure
H values'> 3: High diversity, low ecological pressure

Dominance Index

The Domination Index is used to determine the extent to which a species/genus dominates other groups. The calculation method used is the Simpson dominance index formula (Basmi, 2000).

$$D = \sum_{i=1}^{s} [\frac{ni}{N}]2$$

D = dominance index
Ni = Number of individuals in the i-th type
N = Number of individuals of all types
S = Number of genera or genera

Dominance index criteria according to Odum (1993):
0 <C ≤ 0.5 = There is no dominant species / genus
0.5 <C <1 = There is a dominant species/genus

Measurement data of organic chemical content were analyzed by looking at the permanganate value to determine water quality. Plankton diversity data and permanganate values were analyzed descriptively to determine the relationship between plankton diversity and organic chemical content in Lake Agung Siunter based on water quality criteria according to phytoplankton and zooplankton diversity index.

Determination of permanganate value

Analysis of permanganate value in a one liter sample is intended as the amount of mg of KMnO4 needed to oxidize organic substances contained in one liter of sample with boiling for 10 minutes. Organic matter is determined as a permanganate number with the following equation:
Permanganate Value in water samples
Calculation:

$$KMnO4 = \frac{[(10+a)b-(10 \times c)]x\ 31,6 \times 1000 \times f}{D}$$

With information:
a = The volume of 0.01 N KMnO4 needed at the titration
b = The true normality of KMnO4
c = The normality of oxalic acid
d = The sample volume
f = The dilution factor of the test sample

III. RESULTS AND DISCUSSION

Phytoplankton in Lake Agung Sunter was found that consist of 7 classes and 20 species, and zooplankton consist of 5 classes and 7 species. Table 1 and table 2 show the diversity of phytoplankton and zooplankton. The overall plankton diversity index in Lake Agung Sunter is 0.65 which is classified in waters with low plankton diversity. The waters of Lake Agung Sunter represent poor water quality based on the diversity index of phytoplankton and zooplankton. Phytoplanktons have a role as producer of of a chain in the food web and the largest oxygen producer in thewaters.

Figure 2 and Figure 3 show the percentage of plankton diversity in Lake Agung Sunter from February to August 2019 in 4 differenttimes.

Plankton diversity indicates the presence of organic chemical content in waters that act as nutrients for aquatic biota, especially phytoplankton. The presence of organic substances in waters can be analyzed using the permanganometry method by looking at the number of mg of $KMnO_4$ in water samples as substances that oxidize organic substances in the waters.

Tabel 1. Show the percentage of plankton diversity in Agung Sunter Lake from February to August 2019 in 4 samples

Classis	Species	Sampling				Amount
		1	2	3	4	
Chlorophyceae	*Characium* sp.	221	957	783	-	1961
	Scenedesmus sp.	2	-	3	-	5
	Clorosarcina sp.	1	-	2	-	3
	Pediastrum sp.	14	24	11	8	57
	Ankistrodesmus sp.	-	8	-	-	8
Bacillariophyceae	*Synedra* sp.	585	9677	12039	2574	24875
	Chaetoceros sp.	5	-	6	-	11
	Cycotella sp.	6	-	-	-	6
	Rhizosolenia sp.	2	-	-	-	2
	Coscinodiscus sp.	-	2	260	-	262
	Skeletonema sp.	-	2	-	-	2
	Navicula sp.	1	-	-	-	1
Cyanophyceae	*Spriluna* sp.	50	172	117	53	392
	Anabaena sp.	-	4	-	-	3
	Crococcus sp.	-	-	-	6	6
	Microcystis sp.	-	-	-	9	9
Dinophyceae	*Alexandrium* sp.	-	1	-	-	1
Phyrophyceae	*Closterium* sp.	-	-	30	-	30
Euglenophyceae	*Euglena* sp.	-	-	1	-	1
Phaeophyceae	*Tetraedra elegans*	-	4	-	-	4

Table 2. Zooplankton diversity in Agung Sunter Lake

Classis	Species	Sampling				Amount
		1	2	3	4	
Maxillopoda	*Copepoda* sp.	5	1	2	-	8
	Barnacle sp.	2	-	-	-	2
Malacostraca	*Ampipoda* sp.				13	13
Monogononta	*Keratella* sp.	1	-	9	-	10
	Branchionus sp.	-	-	-	1	1
Xenauplia	*Cyclopoida* sp.	-	-	10	-	10
Cephalopoda	*Nautilus* sp.	-	-	1	-	1

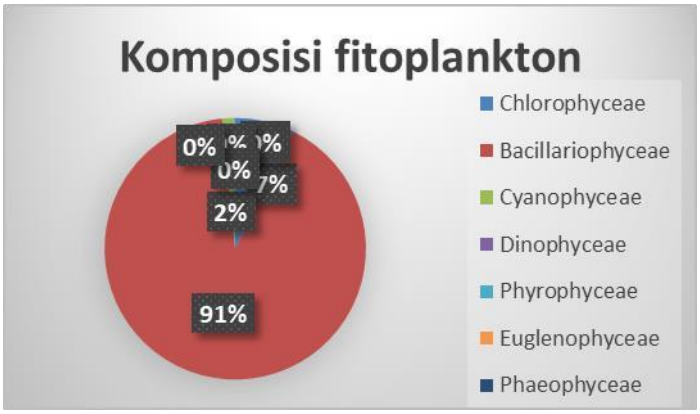

Figure 2. Composition of phytoplankton in Agung Sunter Lake

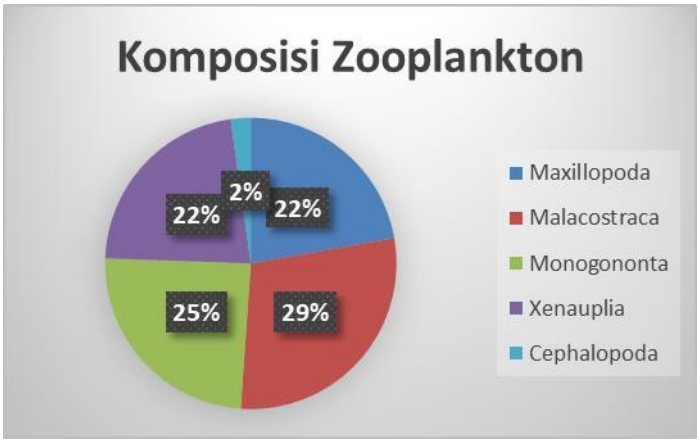

Figure 3. Composition of zooplankton in Agung Sunter Lake

Diversity and Dominance of Plankton

Tabel 1 presents the results of the descriptive analysis of the phytoplankton diversity index in water sampels of Agung Sunter Lake. The compotitions phytoplankton in Lake Agung Sunter in sampling from February to Septemberrepresent

uneven results. Based on Figure 2, there are 7 classes consist of*Bacillaryophyceae* (91%), *Chlorophyceae* (7%), *Cyanophyceae* (2%), *Pyrophyceae* (0.01%), *Phaeophyceae* (0%), *Euglenophyceae* (0%) and *Dinophyceae* (0%). *Bacillariophyceae* is a phytoplankton group that qualitatively is abundant in various river type waters. The *Bacillariophyceae* class is better able to adapt to the existing environmental conditions, this class has a high tolerance and adaptability (Arinardi, 1997). Moreover, according to Figure 3, zooplankton that found in Agung Sunter Lake has a fairly evenly distributed species composition, namely, from class *Malacostraca* (29%), *Monogononta* (25%), *Xenauplia* (22%), *Maxillopoda* (22%) and *Cephalopoda*(2%).

Cyanophyceae diversity in waters can be used as a bioindicator for monitoring water quality. The dominance of species from the *Bacillariophyceae* class indicates that the waters are polluted (Lee, 2006). One example of the *Bacillariophyceae* class is *Synedra* sp., Rangpan (2008) said that its dominance is used as an indication of a decrease in water quality (pollution). The results showed that the condition of Lake Agung was classified as mildly polluted. This result is reinforced by Rangpan (2008) who explains that *Synedra* sp. found to dominate in waters in mildly polluted conditions and *Synedra* sp. able to live in low DO conditions. *Synedra* sp has a high abundance and can be found in a variety of habitats such as wet soils, rock walls, steep coral, peat, and bark. *Synedra* sp. has the ability to withstand changes in unfavorable environmental conditions (Conradie, 2008). Besides Synedra sp. also able to survive in a low nutrient (oligotrific) environment with low nitrogen and phosphate concentrations. This is because *Synedra* sp. able to accumulate nutrients and store them as food reserves in the form of insoluble polymers (Venter, 2003).

Besides *Synedra* sp., the species that dominates Agung Sunter Lake is *Characium* sp.. *Characium* sp. belongs to the *Chlorophyceae* class and it is a primary producer in waters because it has the ability to carry out photosynthesis like higher plants (Kawaroe *et al*, 2010). Its habitat includes all water areas in the world, both fresh water and sea water. *Chlorophyceae* mostly live in fresh water that contains a lot of organic matter such as rice fields, swamps or ponds that are fertilized with manure. *Chlorophyceae* growth in a waters is influenced by the environmental conditions of the waters which include temperature, quality and quantity of nutrients, light intensity, degree of acidity (pH), aeration (source of CO_2) and salinity (Kawaroe et al., 2010).

Higher phytoplankton diversity represent that the aquatic ecosystem at the research area is still relatively stable with the number of phytoplankton species as the main producers being higher than zooplankton as the main consumers of phytoplankton directly (Oktavia et al., 2015). Stable waters with high diversity of phytoplankton allow more biota to be present with higher trophic levels so that aquatic productivity will also increase.

The presence of plankton in a waters is influenced by biotic and abiotic factors. Biotic factors that influence among them are producers, which are a food source for

plankton and the interaction of species and life cycle patterns in each species in the community. According to Hakim et al., (2011), the abiotic factor is the chemical and physics condition of water including temperature, speed of water flow, brightness of water, pH, Dissolved Oxygen (DO), free carbon dioxide (CO2), and Biological Oxygen Demand (BOD).

The average value and range of Shannon's diversity index (H') = 0.65 (0.38-1.12) indicate that the pond waters in the study location belong to the lower category. Furthermore, the dominance index value with the Simpson Dominance indicator (D) which ranges from 0.41 to 0.82 (an average of 0.65) shows generally that there are certain species that are able to adapt well and dominate the region (Figure 4). According to Basmi (2000), if H1 <1, the plankton biota community is declared unstable, if H' ranges from 1-3, then the stability of the plankton biota community is stated in the moderate category and if H1> 3, means the stability of the plankton biota community concerned in prime condition. Phytoplankton species that dominate the Agung Lake Sunter are *Synedra* sp. (*Bacillariophyceae* class), and *Characium* sp. (*Chlorophyceae* class).

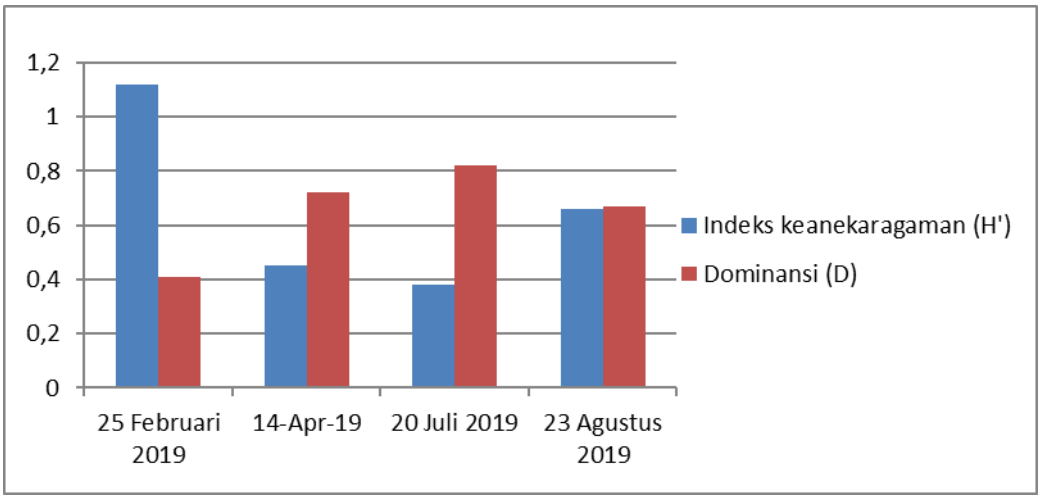

Figure 4. Graph of diversity index and plankton dominance index of Lake Agung Sunter, February-August 2019

The chemical content of organic waters by determining the value of permanganate

Measurement of organic chemical content in water is needed to determine the adequacy of nutrients for plankton growth. The content of organic chemistry can be determined by looking at the permanganate value.

Potassium permanganate value ($KmnO_4$ value) is defined as the number of mg of KMnO4 needed to oxidize organic substances contained in a one liter sample of waterwithboilingfor10minutes.Organicmatterinwaterisdeterminedasa

permanganate number. The content of organic substances in the water indicates that water is polluted and contaminated with waste and is not safe as a source of drinking water.

The results of permanganate test values from February to August are as follows. Based on Figure 5, it can be seen that in sampling I on 14 April 2019, permanganate water samples were taken at 7 points with an average organic matter content of 28.00 mg/L, on sampling II on 25 February 2019, the average content of substances organic matter of 30.00 mg/L, in sampling III dated 20 July 2019 the average content of organic matter was 36.00 mg/L, and sampling IV on 23 August 2019 the average content of organic matter was 36.00 mg/L.

According to the Republic of Indonesia Minister of Health Regulation No. 416/Menkes/Per/IX/1990, the levels of organic substances in drinking water quality standards as permanganate value must be less than 10 mg/L. High levels of permanganate indicate organic matter dissolved in high waters caused by the difficulty of decomposing organic substances.

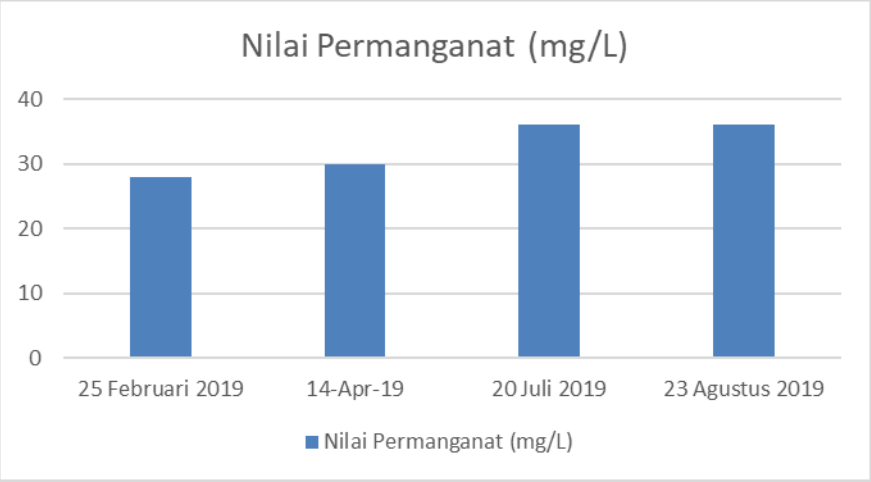

Figure 5. Permanganate value of Agung Sunter Lake, February-August 2019

Organic matter dissolved in water can only be broken down by dissolved oxygen (DO). The high DO is inversely proportional to the permanganate content, while the free CO_2 content in the waters is directly proportional to the permanganate value. The higher the free CO_2, the higher the amount of permanganate. The high content of organic substances in water can reduce water quality. This is because potassium permanganate has a bad impact on other biota such as death of plankton, damage to the plankton food chain, outbreaks of disease against plankton, and damage to ecosystems in thesewaters.

IV. CONCLUSIONS AND SUGGESTIONS

Based on the research, the diversity of plankton in Lake Agung Sunter North Jakarta is classified in the low category with a diversity index of 0.65 and the type of plankton that is dominated is *Synedra* sp. (*Bacillariophyceae* class) and *Characium* sp. (*Chlorophyceae* class). The content of organic matter in the waters provides an optimal contribution to the growth of plankton, thus causing adaptive species that are able to survive and dominate the waters.

Based on the above conclusions, it can be suggested that further research is needed to determine the relation of plankton abundance with organic substances in the waters.

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BIRD COMMUNITY AND DENSITY IN THE MORNING AND AFTERNOON AT SITU PATENGGANG NATURE RESERVE WEST JAVA

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Abstract

Situ Patenggang Nature Reserve consists of a lake and highland forest area covering 120,71 hectares. The existence of bird species generally adjusts to the state of certain habitats. This research was conducted at Situ Patenggang Nature Reserve I and II in West Java on September 2019 to see the comparison of the community and the density of birds in the morning and afternoon. Observation in the morning was at 07.00-10.00 WIB and afternoon was at 14.00-17.00 WIB using the point count method. During observations, the total species composition in the nature reserve area was 60 species consisting of 26 families and 48 genus. When compared in the morning and afternoon, in the morning period there were 54 species of birds, 26 families and 43 genus while in the afternoon period 26 species of birds, 18 families and 22 genus. The morning diversity index value is 2.96 and the afternoon diversity index value is 2.29. Based on the results of the Hutchinson test, there are differences in bird species diversity in the morning and afternoon. Density of birds in the morning is 28.03 individuals/Ha and in the afternoon is 15.70 individuals/Ha. Some of the birds with the highest density in the morning are *Collocalia linchi* (9.95 individuals/Ha), *Lonchura leucogastroides* (2.14 individuals/Ha), *Psilopogon armillaris* (1.39 individuals/Ha) and in the afternoon are *Collocalia linchi* (7.15 individuals/Ha), *Ficedula wastermanni* (2.22 individuals/Ha) and *Psilopogon armillaris* (0.82 individuals/Ha).

Keywords: afternoon, bird, community, density, morning

I. INTRODUCTION

Indonesia is known as home for 1794 bird species, 527 among them are endemic birds (Burung Indonesia, 2020). Java and Bali island are areas that have been separated for a long time from other islands in Indonesia thus providing the opportunities for bird species to adapt and evolve. Java and Bali, with a land area of 138,000 km², have a smaller number of species than Sumatera, which has a larger area (land area of 475,000 km² including the small island), but Java and Bali have twice the number of endemic bird than Sumatera (Holmes and Nash, 1999). Birds as one of the key components of biodiversity are knon as bioindicators and play an important role in thebalanceofecosystems,thusbirdsarenutrientcycleagents,theflowofplantgenes

through pollination, seed dispersing and controlling insect populations (Tesfahunegny et al., 2016).

Patenggang Lake Nature Reserve (CA) is a conservation area located in Java. Based on Decree (Gb) dated 11-7-1919 Number:83 Stbl. 392, forest area and patenggang lake are designated as nature reserve covering 86.18 Ha (DISHUT JABAR, 2008). The measurement results by the West Java Provincial Forestry Service (2002) the area of CA Patenggang is ± 120.71 Ha which is divided into CA Patenggang I covering ± 111.61 Ha and CA Patenggang II covering ± 9.10Ha.

The CA Patenggang area which consist of CA Patenggang I and CA Patenggan II has the potential for abudant bird diversity because it is seen from variety of existing habitats including rivers, lake, heterogeneous forests and homogeneous forests. In the CA Patenggang area there are several species of trees such as puspa (*Schima walichii)*, hiur (*Castanea javanica*), huru (*Litsea angulata*), saninten (*Castanopsis argantea*) and beunying (*Ficus fistulosa*) that can support birds in their morning and evening activities. There are differences in diversity according to Howes et al. (2003), the presence of a particular bird species, in general, is adjusted to its preference for certain habitats. Besides habitat according to Rusmendro (2009), there are differences in species of birds between times (morning and evening) in each habitat, although not in all habitats. The status of conservation areas in this region also promises bird diversity because it cannot be separated from its function, which is a buffer zone that is maintained by the balance of its ecosystem.

Based on this background, research is needed that aims to see the comparison of communities and bird densities between morning andevening.

II. RESEARCH METHODS

A. Study area

The research was conducted on 31 August-3 September 2019. Data was collected at Situ Patenggang Nature Reserve in West Java, which consisted of CA Patenggang I (track 1, track 3) and CA Patenggang II (track 2, track 4) in figure 1.

B. Material research

The equipment used in this research is binoculars, digital cameras, stationery, notebooks, data tabulation, digital watches and GPS. A guide to bird species identification using the Bird's Field Guide book in Sumatra, Java, Bali and Kalimantan (MacKinnon and Philips, 2011) and the book Birds of the Indonesian Archipelago (Eaton et al., 2016). Objects observed were birds and habitats found in Situ Patenggang Nature Reserve.

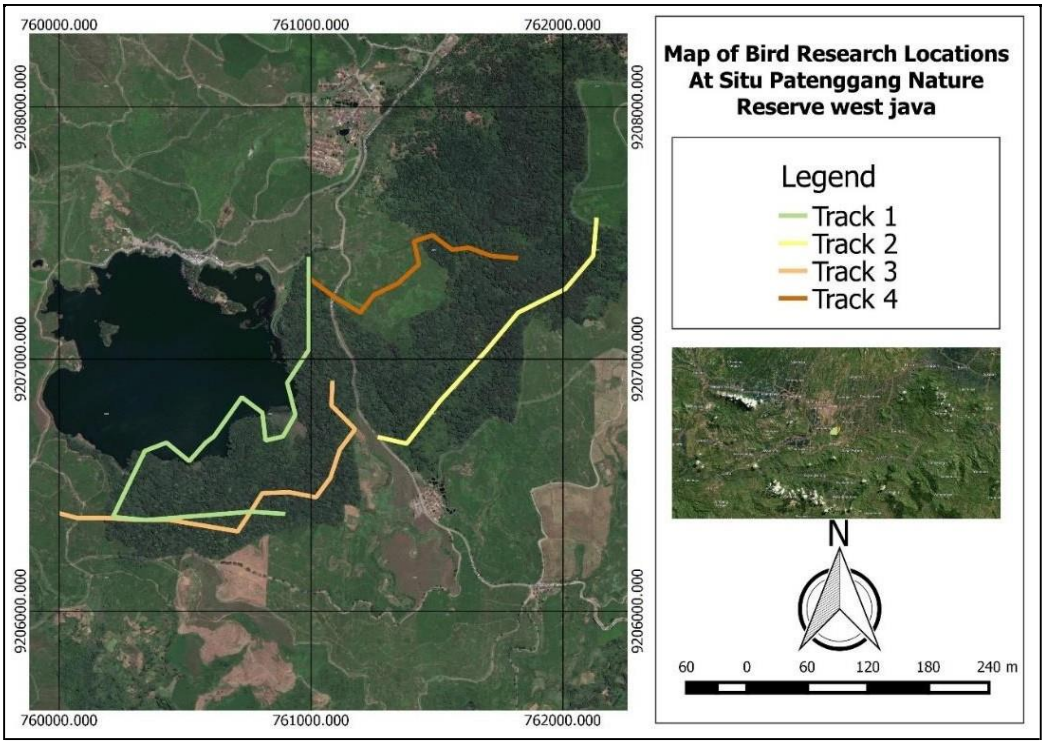

Figure 1. Map of Research location in CA Patenggang I and II

C. Procedures

Observations were carried out twice, in the morning at 07.00-10.00 WIB and in the afternoon at 14.00-17.00 WIB using the point count method at a predetermined point (orientation result). In this method the observer walks along the path and observations are carried out for ± 15 minutes to identify each species of bird that is found either directly (visually) or indirectly (sound) and records observed parameters such as bird species, number of individuals, bird activity and habitat conditions in the observation track. Point area is determined interval between 100 and with the observation radius right and left as far as 25 m (Figure2).

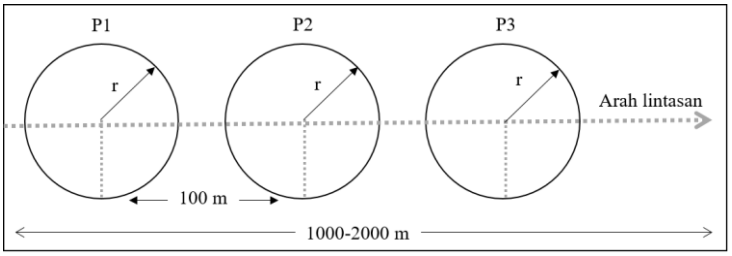

Figure 2. Point count method

D. Data Analysis

SpeciesComposition

Used to determine the species composition of a habitat, species composition at each observation location is compared by calculating the Sorenssen species similarity index (Van Helvort, 1981), namely:

$$IS=\frac{2c}{a+b}\times 100\%$$

IS = Species similarity index
A = Total number of bird species found only in the community a
B = Total number of bird species found only in the communityb
C = Total number of bird species found only in the community c

Species Diversity Index

Used to determine diversity in each habitat. In the calculation of the index value, calculated based on the Shannon-Weaner index (Houston, 1994 with the following equation:

$$H'=-\sum pi \ln pi$$

$$Pi=\frac{ni}{N}$$

Explanation:

H' = Species Diversity Index
Pi = Proportion of importance value of species-i
ni = Number of individuals in species 1
N = Total number of individuals of all species

The H value can then be used to determine the high and low diversity (Maguran, 1988), i.e: H ≤ 1.5 (low diversity), H> 1.5-3.5 (moderate diversity), H> 3.5 (high diversity). Then comparisons were made between the two habitats using the Hutchinson test. This test is also used to determine whether there is a difference in the diversity index of birds between habitat types. This test uses the "t" test with a 95% chance (α = 0.05).

$$\text{var } H_n = \frac{\sum pi\,(Lnpi)^2-(\sum pi\,Lnpi)^2}{N}-\frac{S-1}{2N^2}$$

$$t_{hit} = \frac{H1-H2}{\sqrt{\text{var } H1+\text{var } H2}}$$

Which free degrees (db) can be calculated as follows:

$$db = \frac{(\text{var H1}+\text{var H2})^2}{\frac{(\text{var h1})^2}{N1}+\frac{(\text{var H2})^2}{N2}}$$

Explanation:
Var : Variance, which is differences in species diversity betweenstations
S : Number of foundspecies

Hypothesis rejection criteria: T hit <t0.05 (db) → then H1 = H2, accept H0, there is no difference and T hit> t0.05 (db) → then H1 ≠ H2, reject H0, there is a difference.

Density

Used to determine the number of individual counts of a species per unit area in order to obtain an estimate of the number of individuals in a unit area (Bismark, 2011).

$$D = \frac{\text{Number of individuals of a species}}{\text{Total observed area (Ha)}}$$

III. RESULT AND DISCUSSION

A. Research siteoverview

The CA Patenggang is an area that has a gentle hilly topography, moderate to mountainous with an altitude of 1600 - 1700 meters above sea level and the angle varies between flat to steep around 5-30%. Patenggang I CA is directly adjacent to TWA Telaga Patenggang covering ± 111.61 Ha and CA Patenggang II covering ± 9.10 Ha, which is connected by the PTPN VIII Rancabali plantation area and the Forestry Unit of Perhutani Unit III West Java. Administratively, this area is located within the Patengan Village area, Rancasari District, Bandung Regency (BBKSDA Jabar, 2016).

According to the Schmidt and Ferguson climate classification, this region is classified as type B climate with an average temperature of 23 ° C in the daytime and 17°C at night, and an average rainfall of 3,566 mm per year where the dry month occurs in the month August and September, the rest are wet months (DISHUT JABAR, 2008). Data collection was carried out in four lanes in CA I and CA II, in CA I the pathways was Rengganis - Pasir Hayam and Rengganis - Kebun E9, while in CA II the paths were passed namely Bauan Block- Cihideung Block and Legok Bauan-Labuhan Bulan. The observation track has hydrological potential because it is traversed by the Cirengganganis I, II and III rivers whose water flow fluctuates between the rainy season and the dryseason.

B. Composition and diversity index(H')

The observation of bird species composition found in CA Situ Patenggang can be seen in Table 1.

The composition of bird species found in two times was 60 species consisting of 26 families and 48 genus. The observations showed the highest number of bird species was found in the morning and the smallest in the afternoon. This difference can be caused, in the morning, species of diurnal birds start their activities mainly looking for food and sunbathing with the help of sunlight, but in the afternoon some species of birds more often rest or rest in trees (Rusmendro et al., 2009).

Table 1. Composition of bird species in Situ Patenggang Nature Reserve

Time	Family	Genus	Species
Morning	26	43	54
Afternoon	18	22	26

In this study, 54 bird species from 26 families and 43 genus were found in the morning dominated by the *Apodidae* and *Ploceidae* and *Capitonidae* families. Meanwhile, in the afternoon obtained 26 species of birds from 18 families and 22 genus, dominated by the *Apodidae* and *Muscicapidae* families. Based on the types of birds found in the CA Situ Patenggang area, there are several species of birds that are protected by Ministerial Regulation Number P.106/MENLHK/SETJEN/KUM.1/ 12/2018, several types including Javan Hawk-eagle, Crested Serpent-eagle, Black Eagle, Osprey, Orange-fronted Barbet, Short-tailed Magpie, and Rofus-tailed Fantail. Also found 9 species of birds only on the islands of Java and Bali or Javanese and Balinese endemics including Javan Kingfisher, Javan Hawk-eagle, Olive-backed Tailorbird, Orange-fronted Barbet, Blue-eared Barbet, Crescent-chested Babbler, Black Drongo, Javan Grey-throated, Striated Grassbird, and 4 species found only on Java or Java endemic islands, namely Short-tailed Magpie, Rofus-tailed Fantail, White-flanked Sunbird, and JavanFulvetta.

The diversity index value of bird species in the morning and evening in the CA Situ Patenggang area is 2.96 in the morning and 2.29 in the afternoon. Based on the Shannon-Wiener diversity index criteria, the value is classified as moderate diversity. The Hutchinson test result used to compare bird species diversity indexes in the morning and evening showed that there are differences in bird species diversity in the morning and evening. Alikodra (2002) that several factors can affect the value of species diversity, such as environmental conditions, the number of species and the distribution of individuals in eachtype.

Another factor that can determine the level of diversity at that time, the climate, competition, predators, and productivity (Kiros et al., 2018). The presence of bird species in the morning and evening in each habitat has a different level, according to daily activities and needs in receiving food (Warmetan et al., 2016). According to Sinery et al. (2012), a community that is shared by most communities is composed of many species with an abundance of the same or nearly the same, and vice versa community is prepared only a few species with small dominance so lowherd.

C. Density of birds in the morning and afternoon

Based on the results of the study, the density of bird species in the morning was 28.03 individuals/Ha, while in the afternoon it was 15.70 individuals/Ha (Figure 2). Some species of birds with the highest density in the morning, that *Collocalia linchi* (9.95 Individuals/Ha), *Lonchura leucogastroides* (2.14 Individuals/Ha) and *Psilopogon armillaris* (1.39 Individuals/Ha) while in the afternoon, which *Collocalia linchi* (7.15 Individuals/Ha), *Ficedula wastermanni* (1.07 Individuals/Ha) and *Psilopogon armirallis* (0.82 Individual/Ha).

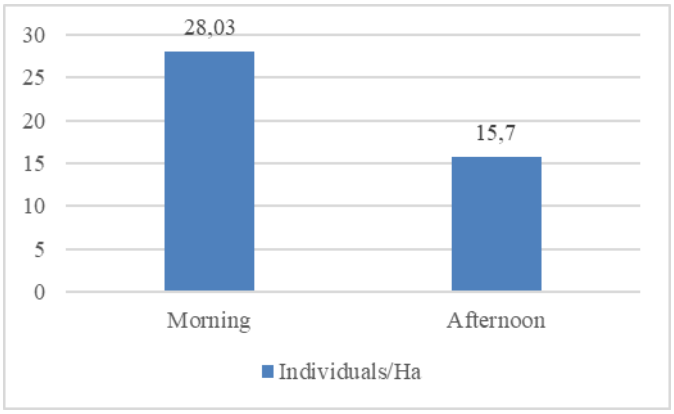

Figure 2. Density of birds in the morning and afternoon at CA Patenggang

The density of different types of bird species in the morning and evening because there are several species of diurnal birds found or spread only in the morning, such as *Cissa thalassina, Ficedula mugimaki*, *Rhipidura phoenicura*, *Rhamphococcyx curvirostris*, and others. As a species that has a high degree of movement with a flying range far to find food (Wrametan et al., 2016) led to some certain bird species is rarely found in the point of observation, either only in the morning or evening. According to Alikodra (1990), population size and density can be influenced by factors of climate conditions, temperature, food, adaptability of a species of wildlife, interactions between individuals, between types and diseases. Differences in bird activity in the morning birds were found to start their activities by flying foraging, singing and playing so that it became the most active time for birds to do activities. Meanwhile, in the afternoon activities carried out are to fly and look for a safe place to rest (Warmetan et al., 2016). The interaction between individual species of birds can be seen from the type of songbird will be very active singing in the morning, like other bird species. Morning with the still dim light conditions and visibility as well as the prospect of bad hunting becomes productive to do the birds in the morning speak to communicate or mark territory. This low light will trigger the desire of birds to speak, therefore apart from in the morning birds tend to sing in the afternoon too (Bird Searcher,2020).

Birds are more active in the morning because most food sources are also active in the morning. Birds will find food by hunting worms, insects and larvae. Even seed-eating birds are more active in the morning because they fill up energy after sleeping at night and collect food supplies before noon (Mayntz, 2019). The morning sun warms the earth can stimulate the insects to move. This causes too many birds active looking for insects in themorning.

During this time, more insects are active in the morning and predatory birds are inactive. Predatory birds like eagles will be active in the afternoon and evening to hunt. This makes small bird is not active in open areas which will be easily visible from raptor vision and prefers to go out in the morning and sleep in a safe place during the day. Meanwhile, in the afternoon, the birds will use the sun for sunbathing. This is done by birds as a parasitic control device as well as exposure to oil preening to the sun creating vitamin D is essential for healthy birds (Bird Searcher,2020).

IV. CONCLUSIONS AND RECOMMENDATION

A. Conclusions

The diversity of bird species found in the morning to afternoon during observations, total species composition in the nature reserve area was 60 species consisting of 26 families and 48 genus. There is a significant difference between the diversity of birds in the morning to afternoon at Situ Patenggang Nature Reserve. Density of birds in the morning is 28.03 individuals/Ha and in the afternoon is 15.70 Individuals/Ha. Bird with highest density in the morning are *Collocalia linchi* (9.95 individuals/Ha), *Lonchura leucogastroides* (2.14 induviduals/Ha), *Psilopogon armillaris* (1.39 individuals/Ha) and in the afternoon are *Collocalia linchi* (7.15 individuals/Ha), *Ficedula wastermani* (2.22 individual/Ha) and *Psilopogon armilaris* (0.82individuals/Ha).

B. Recommendations

Peoples around Situ Patenggang expected to maintain the presence of birds in the wild with no hunting of birds in order to remain sustainable and routine monitoring is needed to determine the dynamics of bird populations around SituPatenggang.

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DIVERSITY OF BIRD PROTECTED IN PLANTATION FOREST AND NATURAL FOREST, GIAM SIAK KECIL–BUKIT BATU BIOSPHERE RESERVES, RIAU

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Abstract

GiamSiak Kecil-Bukit Batu (GSKBB), is one of the biosphere reserves in Indonesia in Riau Province. This area has not been much studied, especially about the interrelationship of the functions of the Industrial Plantation Forest (IPF) and Natural Forest (NF) areas as wildlife habitat. The purpose of this study is to assess the diversity of protected bird species in the IPF and NF, in the GSKBB Biosphere Reserve area. This research was conducted in May 2018, using purposive sampling method with the visual encounter survey. The results found 44 species of birds from 29 families; 11 of them are currently legally protected species in Indonesia; 9 species are listed on Appendix II of CITES, and 3 species with near threatened status (NT) and 3 species with vulnerable status based on IUCN criteria. In general the stability of bird communities in the NF area (H' = 5.59) is better (more stable) than in IPF (H'= 3.15). Bird communities in NF habitats are not the same as IPF (similarity index = 37%); however, the IPF canstillbeutilizedbyprotectedandendangeredspecies.Somebirdspeciesareprotectedand / or endangered and / or listed in Appendix II CITES utilizing IPF areas as habitat, are black-winged kite (*Elanus caeruleus*), white-bellied sea eagle (*Haliaeetus leucogaster*), crested serpent eagle (*Spilornis cheela*), crested hawk-eagle (*Spizaetus cirrhatus*), wreathed hornbill (*Aceros undulatus*), javan banded pitta (*Pitta* sp.) and long-tailed parakeet (*Psittacula longicauda*). Thus the IPF area still has environmental functions, such as bird habitat; as long as it is still protected from poaching.

Keywords : birds-protected, diversity, Biosphere reserve (GSKBB), industrial plantations, natural forest

I. INTRODUCTION

Indonesia has very abundant biodiversity, therefore Indonesia is known as a megabiodiversity country. This can be seen from the diversity of ecosystems, species, and genetics that are spread throughout Indonesia. On the other hand, Indonesia is also the country with the most threatened biodiversity in the world (biodiversity hotspot country). This threat occurs because of the rampant illegal wildlife trade, theft of biodiversity and genetic resources, and weak legal protection (Sukara and Tobing, 2008;

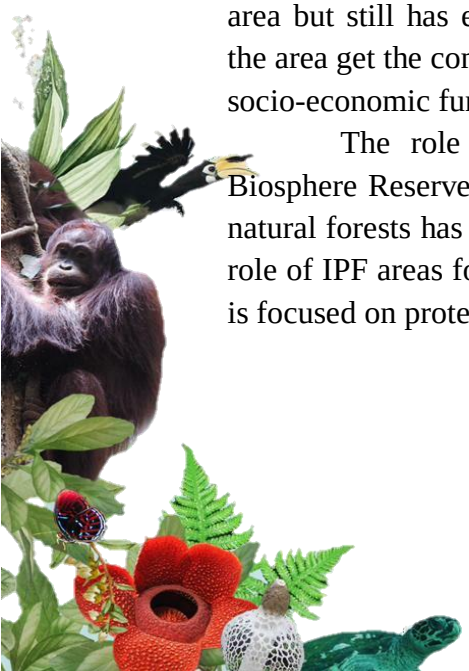
Tobing, 2012). Indonesia's ecosystem richness is predicted to reach 90 ecosystem types, 40,000 plant species and 300,000 animal species (KLH, 2011). Specifically for birds, it is estimated that there are 1,777 species and 515 of them are endemic species (Indonesian Bird, 2019). However, some of them are already in the category of extinction threat; some species are endangered, some have been critically endangered one step before extinction from nature (Haryoko,2010).

The high demand for birds in the market to become pets causes many birds to be hunted and traded. It also poses a major threat to bird preservation in nature. People who like to keep birds, consider these animals unique and interesting because they have a variety of shapes, sounds and colors of feathers. It is known that birds have various functions and benefits which are classified into several values, namely: ecological, economic, cultural, aesthetic, and scientific (Food and Agriculture Organization, 2008; Profauna, 2009). In principle, birds can coexist with the another community as long as the bird's living requirements are met, such as adequate and safe habitat from various forms of disturbance. The existence of birds is very important in maintaining the ecological balance of a region, because birds are dynamic and able to be an indicator of environmental change in an area (Bibby, 2004; Hadinoto *et al*., 2012).

Birds are grouped according to their habitat type because birds can live in a variety of habitat types so that they can always be found in various regions. However, each species has different adaptability, when the habitat has been damaged, the sustainability of various bird species threatened too. Therefore, the worse the habitat conditions, the fewer species can adapt. Bird diversity will be higher in undisturbed conditions than disturbed areas (Kurnia, 2003; Bibby, 2004; Metz, 2005).

The Giam Siak Kecil and Bukit Batu area in Riau is a conservation area that has been designated as a Biosphere Reserve by UNESCO in 2009. The designation of the Giam Siak Kecil-Bukit Batu as a Biosphere Reserve aims to synergize the function of the area within separate management. The GSK-BB Biosphere Reserve has an area of 1,787 km2 which is dominated by peatlands. The area is divided into three zones, namely the core zone, the buffer zone and the transition zone. In our research, we examined the core and buffer zones. The core zone is the main habitat of biodiversity which consists of natural forests with full environmental functions, while the buffer zone which is dominated by plantations forest is intended as an economic development area but still has environmental functions although not fully. Thus the people around the area get the complexity of the function of the area; both environmental functions and socio-economic functions (Fujita et al, 2012; PERMEN LHK,2015).

The role of the Industrial Plantation Forest (IPF) area in the GSK-BB Biosphere Reserve as an environmental function especially as a bird habitat as well as natural forests has never been studied. Therefore, this research is designed to assess the role of IPF areas for the benefit of the environment, especially as bird habitat. Research is focused on protected endangered birds and the stability of their communities, to better



reveal the important role of each region, both the core zone (Natural Forest) and buffer zone (Industrial Plantation Forest) areas as bird habitat and conservation.

Based on this background, this study aims to prove the environmental function of Insndustrial Plantation Forest areas as protected bird habitats. The hypothesis proposed in this study is that the composition and diversities of protected and/or endangered bird communities is different between the core zone (natural forest) and the buffer zone (Industrial Plantation Forest) area.

II. RESEARCH METHODS

A. Study area

The study was conducted in the Giam Siak Kecil - Bukit Batu Biosphere Reserve area (GSK-BB), Riau. The research location is in the core area of the Humus Block which is one of the important areas in the GSK-BB Biosphere Reserve in Riau because this area also includes a plantation forest managed by a company that is concerned with nature conservation. This is evident that GSK-BB is a biosphere reserve initiated by the private sector (Sinar Mas Forestry).

B. Materials research

The instruments used in this study are binoculars, digital clocks, cameras, and field handbooks about birds in Sumatra, Kalimantan, Java, and Bali (MacKinnon et al, 2010).

C. Procedures

The study was conducted using a purposive sampling method by dividing the area into two categories, namely natural forest areas (core zone) in the form of GiamSiak Kecil conservation areas with heterogeneous vegetation and industrial plantation forest areas with homogeneous vegetation (acacia). Observations were made in two areas in rotation every day from morning to evening. Observations were made by identifying bird species detected (visual encounter survey) in each region with the help of binocularbinoculars.

D. Data analysis

1. The composition of the bird community

The bird species that were detected during the observation were grouped according to the condition of the area (natural forest and plantation forest). An assessment of the presence/absence of differences in the composition of bird

communities between regions (Industrial Plantation Forest dan Natural Forest) was concluded using a similarity index (IS) (Brower *et al*., 1990).

$$IS=\frac{2C}{A+B}x100\%$$

- IS = index ofsimilarity
- c = the same number of species in the Primary Forest and HTIareas
- a = number of species in the Primary Forestarea
- b = number of species in the HTIarea

Assessment criteria :
- IS> 50%: composition of bird communities between regions is thesame
- IS <50%: composition of bird communities between regions isdifferent

2. Feeding guild

Detected bird species are classified according to the main feed category, to assess whether / not there is a tendency for area use by a category. The classification is based on 10 categories of similarity in feed types as described by Mackinnon et al (2010), namely insectivores (invertebrate eaters, insects, and worms), granivores (seed-eaters), frugivores (fruit eaters), nectarivores (nectar eaters) and carnivores (insects and worms) predators / eaters of small vertebrates), insectivores-granivores (IG), insectivores-frugivores (IF), carnivores-insectivores (KI), frugivores-granivores (FG) and insectivores-granivores-frugivores (IGF).

3. Stability of the bird community

The stability of bird communities between regions was analyzed using the Shannon-Wiener index and Evennes index

a. Diversity

The diversity of bird species in each region was assessed based on the Shannon-Wiener diversity index (Magurran, 1988), using the equation;

$$H = - \sum Pi \, . \, ln \, Pi$$

- H = indexdiversity
- Pi=ni/N
- ni = the number of individuals of eachtype
- N =total number of individualsfound

Assessment criteria
- H<1,5 =low
- 1,5 ≤ H≤3,5 =middle
- H>3,5 =high

b. Evennes index

Evenness index functions to find out evenness of every bird species in each community. Evenness of bird species can be calculated using the formula (Fachrul, 2012), namely:

$$E = \frac{H'}{\ln S}$$

- H = Shannon-Wiener DiversityIndex
- S = Number of species found (speciesrichness)

If the evenness index value of a species approaches the value of one, the species of birds found in the community is more evenly distributed and if the evenness index value is close to zero, it indicates an inequality of bird species in a community (Fachrul,2012).

III. RESULTS AND DISCUSSION

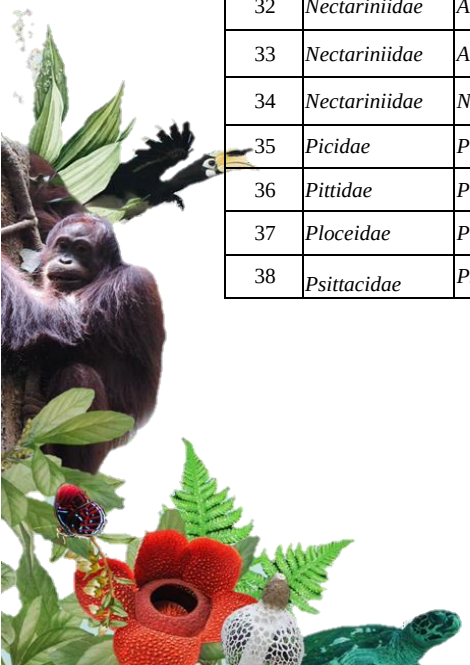
1. The composition of the bird community

The composition of bird species in Industrial Plantation Forest (IPF) and Natural Forest (NF), GSKBB biosphere reserves found 44 species originating from 29 family. Based on the comparison between IPF and NF, the most number of species was found in IPF with 31 species from 23 family, while in NF there were 23 species from 17 family (Table 1). The similarity index (IS) value between IPF and NF is 37%, this shows that the different composition of bird communities between regions. According to Lack (1971), the number of bird species found in a habitat depends on the characteristics of the habitat and is also influenced by the level of use of available resources.

Table 1. Species diversity and bird protection status scattered in Natural Forest (NF) and Industrial Plantations Forest (IPF), Giam Siak Kecil Bukit Batu – Riau – Indonesia.

No	Family	Species	Common name	Status				Habitat	
				Regulation		IUCN	CITES		
				PP 7/ 1999	P. 106 / 2018			NF	IPF
1	*Accipitridae*	*Elanus caeruleus*	*Black-winged Kite*	V	V	LC	II		1
2	*Accipitridae*	*Haliaeetus leucogaster*	*White-bellied Sea Eagle*	V	V	LC	II		1
3	*Accipitridae*	*Spilornis cheela*	*Crested Serpent Eagle*	V	V	LC	II	2	1

No	Family	Species	Common name	Status				Habitat	
				Regulation		IUCN	CITES		
				PP7/ 1999	P. 106 / 2018			NF	IPF
4	*Accipitridae*	*Spizaetus cirrhatus*	*Crested Hawk-Eagle*	V	V	LC	II		1
5	*Alcedinidae*	*Alcedo meninting*	*Blue-earned Kingfisher*	V		LC		2	5
6	*Alcedinidae*	*Halcyon pileata*	*Black-capped Kingfisher*	V		LC			1
7	*Alcedinidae*	*Halcyon smyrnensis*	*White-throated Kingfisher*	V		LC		1	2
8	*Apodidae*	*Collocalia linchi*	*Cave Swiftlet*			LC			7
9	*Ardeidae*	*Ardea purpurea*	*Purple Heron*			LC			2
10	*Artamidae*	*Artamus leucoryn*	*White-breasted Woodswallow*			LC			3
11	*Bucerotidae*	*Aceros undulatus*	*wreathed hornbill*	V	V	VU	II	6	4
12	*Bucerotidae*	*Anthracoceros malayanus*	*black hornbill*	V	V	VU	II	10	
13	*Campephagidae*	*Pericrocotus igneus*	*ry minivet*			NT			1
14	*Capitonidae*	*Psilopogon pyrolophus*	*fire-tufted barbet*	V	V	LC		1	
15	*Columbidae*	*Geopelia striata*	*zebra dove*			LC		1	
16	*Columbidae*	*Streptopelia chinensis*	*spotted dove*						1
17	*Corvidae*	*Corvus macrorhynchos*	*Large-billed Crow*			LC			2
18	*Cuculidae*	*Cacomantis sepulcralis*	*Rusty-breasted Cuckoo*			LC			1
19	*Cuculidae*	*Centropus bengalensis*	*lesser coucal*			LC		1	2
20	*Cuculidae*	*Phaenicophaeus diardi*	*black-bellied malkoha*			NT			2
21	*Cuculidae*	*Phaenicophaeus javanicus*	*red-billed malkoha*			LC		1	
22	*Dicaeidae*	*Dicaeum trigonostigma*	*orange-bellied flowerpecker*			LC		1	3
23	*Dicaeidae*	*Prionochilus percussus*	*Crimson-breasted Flowerpecker*			LC		1	
24	*Dicruridae*	*Dicrurus paradiseus*	*greater racket-tailed drongo*			LC		1	2
25	*Estrilidae*	*Lonchura punctulata*	*scaly-breasted munia*			LC			7
26	*Falconidae*	*Microhierax fringillarius*	*Black-thighed Falconet*	V	V	LC	II	2	
27	*Hemiprocnidae*	*Hemiprocne comata*	*whiskered treeswift*			LC		1	
28	*Hirundinidae*	*Hirundo tahitica*	*Pacific swallow*			LC			2
29	*Indicatoridae*	*Indicator archipelagicus*	*Malay Honeyguide*	v	V	NT			1
30	*Irenidae*	*Irena puella*	*Asian fairy-bluebird*			LC		1	
31	*Laniidae*	*Lanius schach*	*long-tailed shrike*			LC			1
32	*Nectariniidae*	*Aethopyga siparaja*	*crimson sunbird*	V	V	LC			2
33	*Nectariniidae*	*Anthreptes malacensis*	*brown-throated sunbird*			LC		2	
34	*Nectariniidae*	*Nectarinia jugularis*	*olive-backed sunbird*			LC		2	
35	*Picidae*	*Picus miniaceus*	*Banded Woodpecker*			LC		1	
36	*Pittidae*	*Pitta guajana*	*Javan banded pitta*			LC	II		1
37	*Ploceidae*	*Passer montanus*	*Eurasian tree sparrow*			LC		4	9
38	*Psittacidae*	*Psittacula longicauda*	*long-tailed parakeet*	V	V	VU	II	1	5



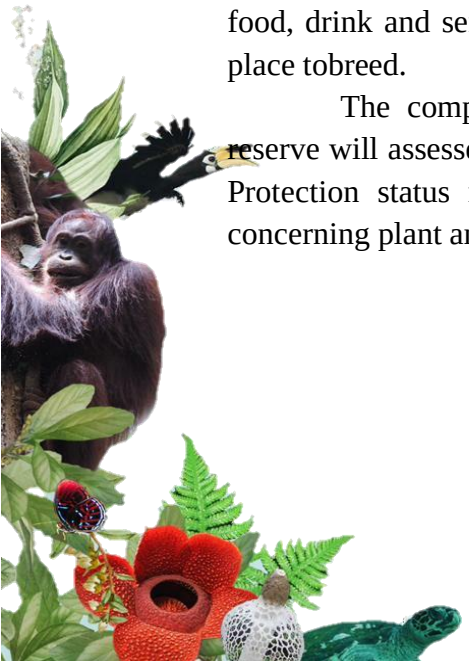
No	Family	Species	Common name	Status				Habitat	
				Regulation		IUCN	CITES		
				PP7/ 1999	P. 106 / 2018			NF	IPF
39	*Pycnonotidae*	*Pycnonotus aurigaster*	*sooty-headed bulbul*			LC			1
40	*Pycnonotidae*	*Pycnonotus goiavier*	*yellow-vented bulbul*			LC		1	2
41	*Rhipiduridae*	*Rhipidura javanica*	*Malaysian pied fantail*	V	V	LC			1
42	*Sturnidae*	*Aplonis panayensis*	*Asian glossy starling*			LC		1	
43	*Turdidae*	*Copsychus saularis*	*oriental magpie-robin*			LC		3	
44	*Zosteropidae*	*Zosterops palpebrosus*	*Oriental white-eye*			LC			1
								23	31

- PP 7/1999 = Indonesian government regulation No.7 / 1999; P.106/2018 = Indonesian Minister of Environment and Forestry Regulations; IUCN = IUCN Red List of Threatened Species;CITES=CITES(ConventiononInternationalTradeinEndangeredSpeciesofWild Fauna and Flora) Appendix; IPF = Industrial Planted Forest; NF = NaturalForest;

Unlike the case with mammals; the composition of the mammal community in the Bukit Batu Riau region is very different between HTI (Acasia) and natural forest (peat forest). The results of the study of Fujita et al (2012) only found one species of mammals in the Industrial Plantation Forest (Acasia) area, common palm civet (*Paradoxurus hermaphroditus*). While of the 19 species of mammals found, 13 of them are only found in conservation areas (natural forests) including endangered species such as sun bears (*Helarctos malayanus*), leopards (*Neofelis diardii*), and marbled cat (*Pardofelis marmorata*), which indicate irreplaceable value from the natural forest for mammals. The natural forest which is the "core area" in the GSK-BB Biosphere Reserve is "home tomammals".

Accipitridae are the most commonly found in IPF. There are 4 species of birds included in the Accipitridae in IPF, namely black-winged kite (*Elanus caeruleus*), white-bellied sea eagle (*Haliaeetus leucogaster*), crested serpent eagle (*Spilornis cheela*), and crested hawk-eagle (*Spizaetus cirrhatus*). Family Accipitridae scattered in the IPF region, supported by an abundance of resources needed; and if resources rarely or not be found in the IPF region, it cannot meet the needs for birds. Al Haq et al (2011) says, an area that is often visited by birds because in these habitats it can provide food, drink and serves as a shelter/hiding place, a place to rest, a place to sleep and a place tobreed.

The composition of birds found in two habitats in the GSKBB biosphere reserve will assessed from the aspects of protection status, trade status and threat status. Protection status refers to Ministry of Environment Regulation No. 106 of 2018 concerning plant and animal species protected by trade status refers to CITES



(Convention on International Trade in Endangered Species of Wild Fauna and Flora) and threat status refers to IUCN (International Union for Conservation ofNature).

There are 12 species that have protection status based on Ministerial Regulation Number 106 of 2018; and 9 species of which were found in IPF, namely: black winged kite, white belly sea eagle, crested serpent eagle, crested hawk eagle, wreathed hornbill, malayan honeyguide, crimson sunbird, long-tailed parakeet, , and malaysian pied fantail. Nine species that are included in CITES Appendix II (species whose status is not yet threatened but will be threatened with extinction if exploited excessively); and 7 species of which were found in IPF, namely: black winged kite, white belly sea eagle, crested serpent eagle, crested hawk eagle, wreathed hornbill, Javanese banded pitta, and long-tailed parakeet. And 3 species that are near threatened (NT), all three are found on the IPF, namely: fiery minivet, black-bellied malkoha, and malay honeyguide. In addition, 3 vulnerable species were found, and 2 of them were found in IPF, namely : wreathed hornbill, and long-tailed parakeet based on IUCN threat status (Table1).

2. Feeding guild

There are 11 groups based on the similarity of food types (Mackinnon, 2010), namely insectivores (invertebrate eaters, insects, and worms), granivores (seed eaters), frugivores (fruit eaters), nectarivores (nectar eaters), and carnivores (small vertebrate eaters), insectivorous-granivorous (IG), insectivorous-frugivorous (IF), carnivorous-insectivorous (KI), frugivorous-granivorous (FG), insectivorous-nectarivora (IN) and insectivorous-granivorous-frugivore (IGF) (Fig. 1). Based on the picture 1 the insectivorous group of birds has the highest percentage compared to the number of other groups of birds.

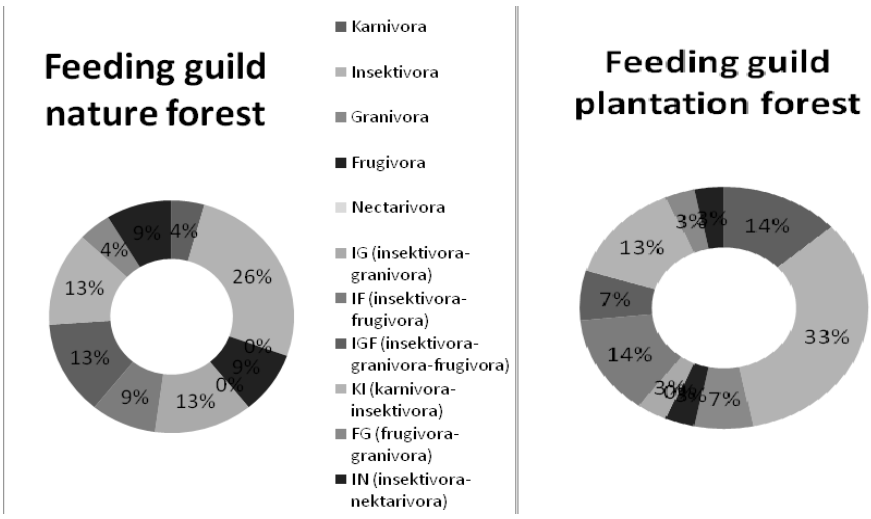


Figure 1. Bird guild feeding diagram in Giam Siak Kecil Bukit Batu Biosphere Reserve

A guild is a group of species that utilizes the same resources and in the same way. A group of species can be said to have the same guild based on how the group of species obtains resources, for example feed resources or feeding guilds (O'Connell et al., 2000). However, the abundance of insectivorous birds in the region identified a change in habitat or disturbance (Sekercioglu et al.,2002).

3. Habitat stability

Species diversity in an area is determined by various factors. Species diversity has a number of components that can react differently to geographical and physical development factors, one of the main components is species richness (Odum, 1993). Based on the results obtained, the Shannon-Wiener (H) diversity index of bird species in Natural Forest is higher than that of Industrial Plantations (Figure 2.).

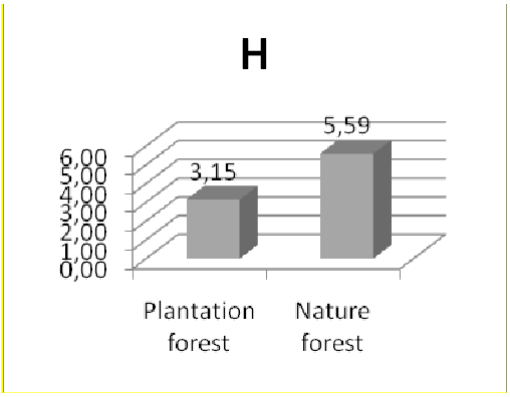


Figure 2. Diversity Index in Giam Siak Kecil Bukit Batu Biosphere Reserve

Diversity index is a high or low value that shows the stability of the community. Communities that have a higher diversity value will make the relations between components in the community more complex (Dewi, 2005). Factors that influence the size of the value of species diversity are environmental conditions, the number of species and the distribution of individuals in each species (Alikodra, 1990). Based on observations, the diversity index of bird species in IPF is 3.15 which is included in the medium category and NF is 5.59 which is included in the high category, if diversity is said to be moderate if the value of H '> 1.5 - 3.5 (Magurran, 1988). This shows that the diversity of bird species in the region is relativelystable.

The value of diversity in NF is higher than in IPF due to the preservation of the forest and not much human activity in the habitat. Meanwhile, in the Industrial Plantation Forest, in addition to only one type of plant, there is also human activity due to its location close to the workers' camp settlements.

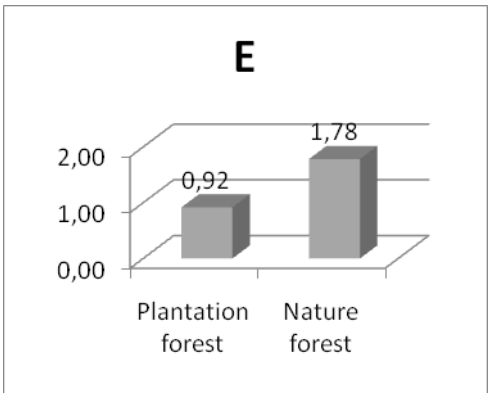


Figure 3. Evenness Index in Bukit Batu's Giam Siak Kecil Biosphere Reserve

Based on the figure 3, the value of species evenness index (E) on NF has a value of 0.92 and IPF of 1.78 from both habitats included in the high category. If the evenness index of bird species is close to zero, this shows that the types of birds found in a community are uneven. The species evenness index value can indicate that a habitat is able to meet the availability of feed of a bird species so that intra-species competition is not toohigh.

From the results of the evenness index obtained species of birds found on NF and IPF have almost the same evenness between habitats. This value can make that the habitat in each peatk has the power to meet the availability of food of a type so that there is no high competition between species. According to Novarino (2010), the value of diversity and evenness of species will be evenly distributed when the location of bird species found is spread evenly with the same number ofindividuals.

IV. CONCLUSIONS AND RECOMMENDATION

1. The GSK-BB biosphere reserve has 44 bird species from 29 family, and includein 31 species from 23 family on industrialforest;
2. Diversity index in the GSK-BB biosphere reserve is included in the high category with a value of 3,15 in industrial forest and 5.59 in natural forest and density index include high categorytoo;
3. Biosphere reserve GSK-BB has 14 species, and 12 spescies in industrial foresty on protected bird species, both based on the status of Ministerial Regulation No. 106 in 2018, IUCN, andCITES
4. Birds protected use industrial forestry forhabitat

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MANGROVE COMMUNITY IN THE PROTECTED FOREST AREA OF ANGKE KAPUK, MUARA ANGKE, NORTH JAKARTA

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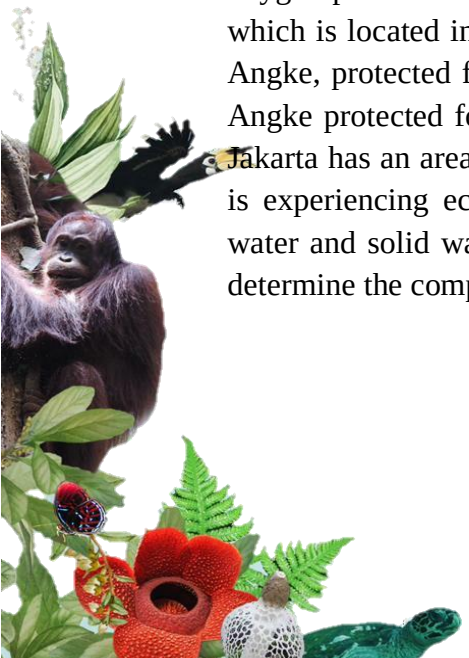
Abstract

Jakarta Bay has a mangrove forest area which is located in the Northern Jakarta region. The area is the wildlife reserve Muara Angke, protected forest Angke Kapuk, Muara Angke, and nature tourism park Angke. Angke protected forest at the village of Kapuk Muara, Penjaringan sub district, North Jakarta has an area of 44.76 ha. Currently the Angke Kapuk Mangrove protected forest is experiencing ecological stress due to land and beach development such as waste water and solid waste disposal. Based on this, regular monitoring needs to be done to determine the composition and structure of the Mangrove community there. Data collecting was design using quadratic method with 9 main plots measuring 50 X 50 cm. The results showed that there were 27 species, 23 genus, and 20 family of plant consists of 13 species of true Mangrove and 14 species of non Mangrove. *Avicennia marina* is the highest important value index which is 238.06, 186.38, and 203.52 for the level of tress, sapling, and seedling respectively. Species diversity index is 0.84, 1.36, and 1.14 for the level of tress, sapling, and seedling respectively. In general, species diversity index of Mangrove in each growth level is relatively low. This research also showed that compared to the data in 2007 there was a decline in the number of Mangrove species by 25%.

Keywords : Mangrove, protected forest Angke Kapuk, Muara Angke

I. INTRODUCTION

Mangrove forest is a forest located at the mouth of a river, tidal or waterfront area. Mangrove plants are unique because it is a combination of the characteristics of plant that live on land and at sea. Mangrove generally have a prominent root system called the root of the breath (pneumatophore). This root system is a way of adaptation to oxygen poor or even anaerobic soil conditions.Jakarta Bay has a mangrove forest area which is located in the Northern Jakarta region. The area is the wildlife reserve Muara Angke, protected forest Angke Kapuk, Muara Angke, and nature tourism park Angke. Angke protected forest at the village of Kapuk Muara, Penjaringan sub district, North Jakarta has an area of 44.76 ha. Currently the Angke Kapuk Mangrove protected forest is experiencing ecological stress due to land and beach development such as waste water and solid waste disposal. Based on this, regular monitoring needs to be done to determine the composition and structure of the Mangrove communitythere.



II. RESEARCH METHODS

A. Location and Time of Research

The study was conducted on 11 plots around the Angke Kapuk protected forest area, North Jakarta (Figure 1).The study was conducted in September-October 2017.

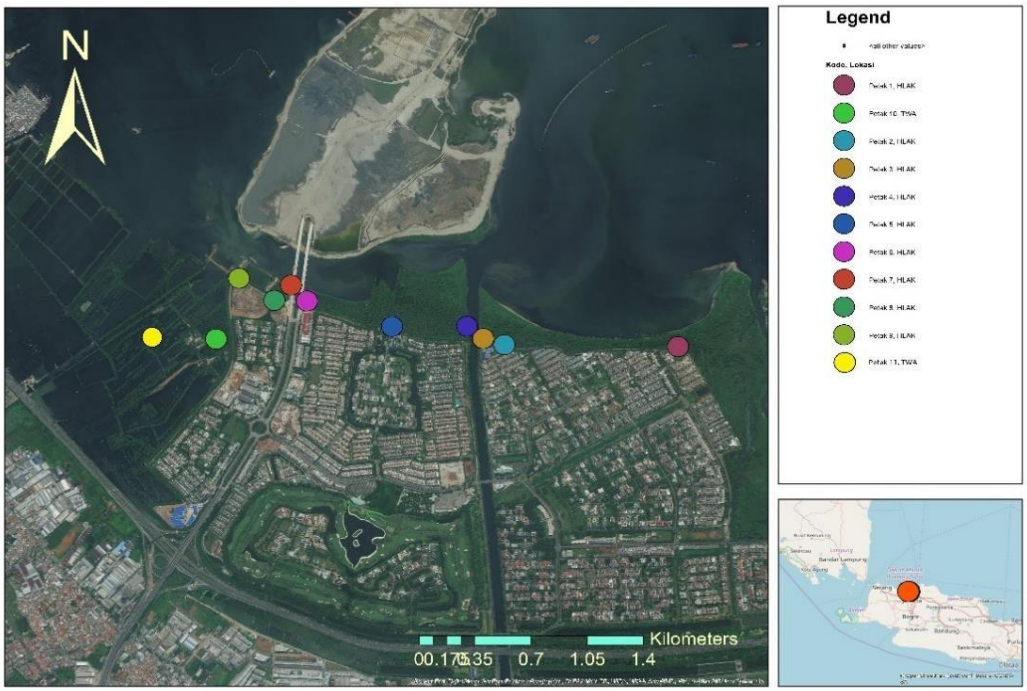


Figure 1. Mangrove Research Location

B. Tools and Materials

Equipment and materials used in this study include stationery, plastic straps, tagging tape, roll meter, mangrove field guide books in, digital cameras, GPS, binoculars andcounters.

C. Procedure

Vegetation observations made in plots of quadratic shapes for tree, sapling and seedlings. The main plot was 9 plot measuring 50 x 50 m. In the main plot a smaller square plot was made which was 10 X 10 m to measure tree stands (> 4 cm in diameter), 5 X 5 M for sapling stands (diameter , 4 cm, height > 1 m), and 2 X 2 M for seedling stands (height < 1 m) as shown in Figure 2. Field data recorded or measured includes plant species, the number of individuals of each species, height, and diameter of the tree in eachplots.

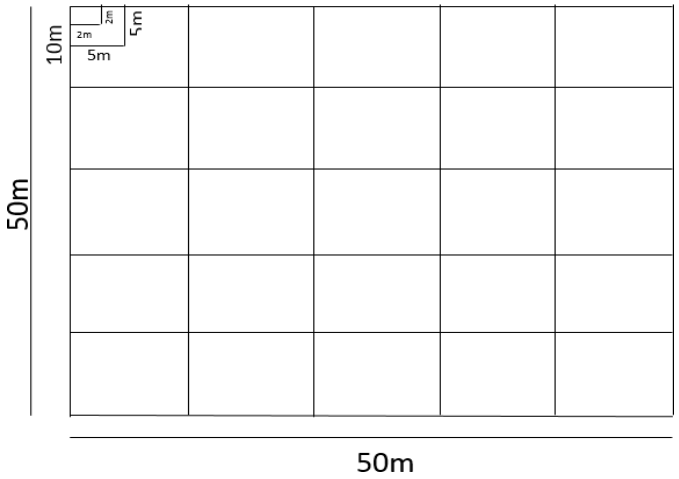


Figure 2. Observation plot

D. Data analysis

1. Species composition

The degree of similarity in species composition in the community was compared using the Sorensen Index (Mueller et al, 1974).

$$IS = \frac{2W}{a+b} \times 100$$

SI = Similarity Index
W = The smallest number of important values of a species in the two communities being compared
a = The sum of important values of all species in one community (a)
b = The sum of important values of all species in community (b) being compared

2. Species diversity

Species diversity was calculated using the following Shannon Wiener (H') diversity index (Magurran, 1987) :

$$H' = \sum pi \ln pi$$

H' = Shannon Wiener Species Diversity Index
Pi = ni/N
ni = Number of individuals to i
N = Number of individuals of all species

According to Kreb (1985), the criteria used to determine the value of species diversity index (H'), namely:
H'≤ 1 = lowdiversity
1 < H' < 3 = moderate diversity
H'>3 = highdiversity

3. Important valueindex

Species dominance in each habitat is indicated by an important value index (Smeins and Slack, 1982) :

a. Density

Absolute density = Number of individuals of species to i/the total area used for sampling

Relative Density = absolute density of species to i/total density of all species present in the sample collection X 100 %

b. Domination

Absolute domination = number of basal areas of species i/total basal area of all species

Relative domination = absolute domination species i/total absolute domination of all species X 100 %

c. Frequency

Species frequency i = number of plots containing species i/total number of observation plots

Relative frequency = species frequency i/total frequency of all species X 100 %

d. Important Value Index (IVI)

IVI = Relative Density + Relative Domination + Relative Frequency

III. RESULTS AND DISCUSSION

A. Species Composition

Based on observations of vegetation in the protected forest Angke Kupuk, Muara Angke recorded as many as 27 species of plants, 23 genus and 20 families (Figure 3), consists of 13 species of true mangrove and 14 other species.

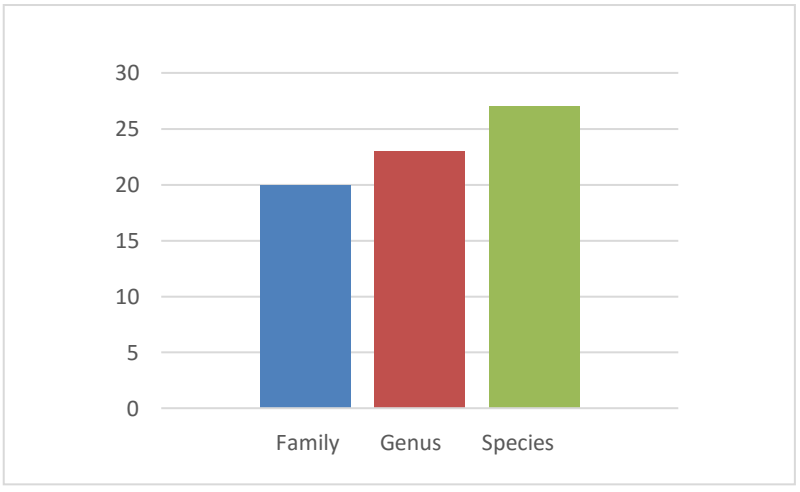


Figure 3. Total plants in the protected forest Angke Kapuk, Muara Angke

Lukman (2007) reported that in Angke kapuk Protected Forest there were 36 species of plants, 32 genus, and 27 families of plants consisting of 9 species of true mangrove and 27 other species. This shows there has been a decline in the number of plant species (Figure 4) by 25 % over the past 10 years.

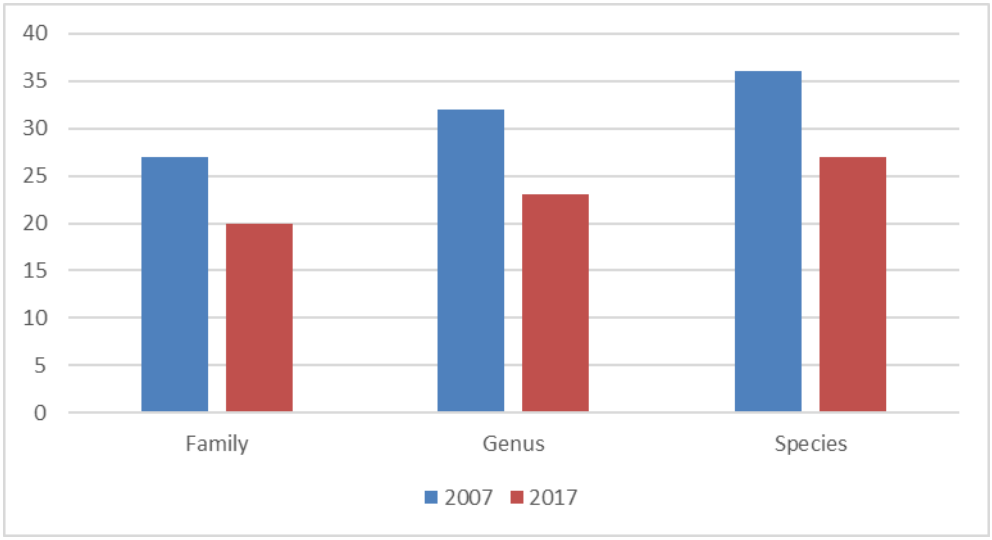


Figure 4. Comparison graph of total plants in Kapuk Angke, Kamal Muara Protected Forests in 2007 and 2017

Generally the decline in species occurs not in true mangrove plants such as plant species of *Ceiba petandra*, *Cocos nucifera*, *Ficus benyamina*, *Ageratum conyzoides* and others due to impact of solid waste, water pollution, and human activities.

Based on the growth rate recorded 14 species of mangrove plants at the tree level, 15 species of sapling level, and 21 species of seedling level (Figure 5).

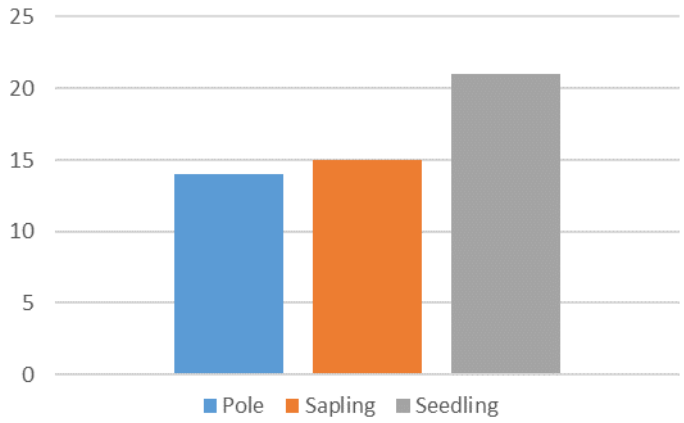


Figure 5. Graph of the number of mangrove vegetation species in each growth stand

Based on the level of similarity between growth stands show a fairly high level of composition similarity (Table 1).

Table 1. The value of the similarity index between growth stands

	Pole	Sapling	Seedling
Pole	*	68,96	57,14
Sapling		*	66, 66
Seedling			*

B. Community Structure

1. Species frequency

The results of observations show that the relative frequency values for tree stands, sapling and seedling are *Avicennia marina* respectively 60.25 %, 42.5 % and 43.35 %.

2. Density level

The total number of each stand in 1 hectare is 1,268.88 individuals in trees, 1,046.42 in sapling, and 27,088.88 in seedling. *Avicennia marina* are species that have the highest relative density values for tree, sapling, and seedling levels 60.25 %, 86.2 % and 67.18 % respectively.

3. Dominant Species

The most dominant species of mangrove in Kapuk Angke Protected Forest area is Avicennia marina with a relative dominance value of 98.96 %, 86.2 %, and 92.98 % for tree, sapling, and seedling levels respectively.

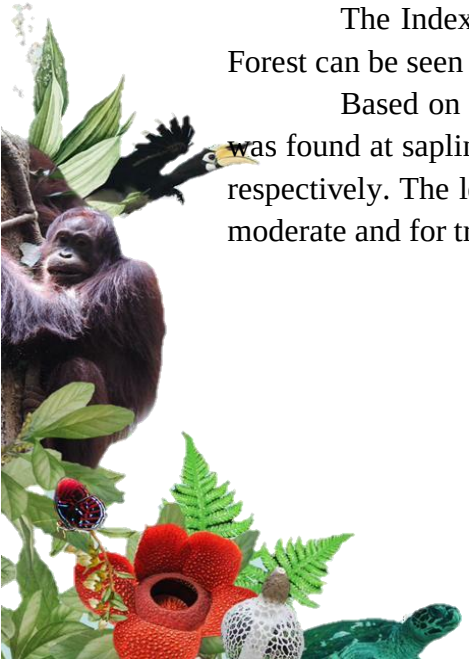
4. Important Value Index

Avicennia marina is a species of mangrove that has the highest Important Value Index, which is 238.06 %, 186.38 %, and 203.52 % respectively for the level of trees, sapling, and seedling. This shows that Avicennia marina is a species that is able to adapt well in the Kapuk Angke Protected Forest area dan is a species that can live well in tidalareas.

C. Species Diversity

The Index Value of Diversity of mangrove species in Angke Kapuk Protected Forest can be seen in Figure 6.

Based on Figure 6, it can be seen that the highest plant species diversity index was found at sapling level, followed by seedlings and trees, namely 1.36, 1.14 and 0.84 respectively. The level of diversity of seedling and sapling plant species is classified as moderate and for tree classified as low diversity.



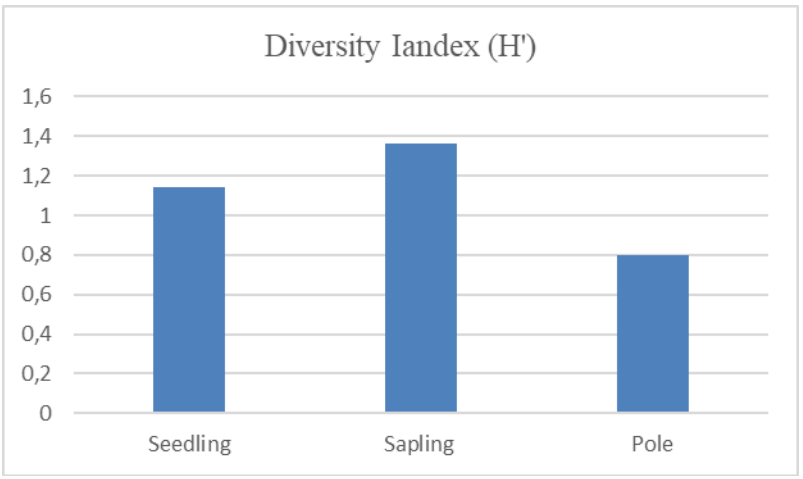


Figure 6. Graph of diversity index of plant species in Kapuk Angke Protected Forest

Comparison of plant species diversity index in 2007 and 2017 can be seen in Figure 7.

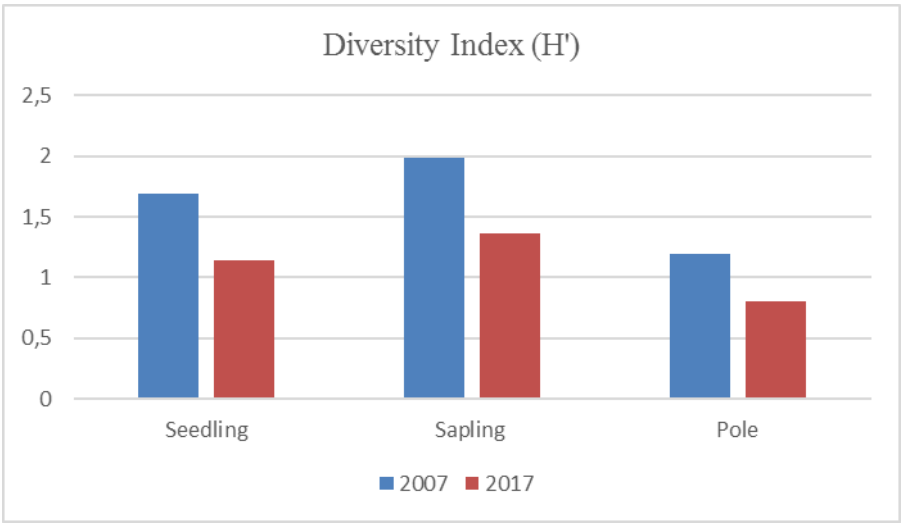


Figure 7. Comparison graph of plant species diversity index in the Kapuk Angke Protected Forest in 2007 and 2017

Based on Figure 7 it can be seen that there was a decline in plant diversity in 2017 compared to 2007. This can be caused by worsening environmental conditions and increasing ecological stress or pressures from year to year either due to natural conditions or due to human activities or development. In 2007 the diversity index value at all growth levels was classified as moderate but in 2017 the tree growth level dropped to low.

IV. CONCLUSION

1. Total plants in Kapuk Angke Protected Forest consists of 27 species, 23 genus, and 20 families. There is an indication of a 25 % decline in species diversity over the last 10years.
2. Diversity of plant species for the level of sapling and seedling is classified as moderate, while the diversity of plant species is relatively low in the level oftrees.
3. The dominant species of Mangrove for all stages of growth in Kapuk Angke Protected Forest is *Avicennia marina*.

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COMPOSITION AND DIVERSITY OF AVIFAUNA IN THE MANGROVE PROTECTED FOREST AREA OF ANGKE KAPUK, MUARA ANGKE, NORTH JAKARTA

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Abstract

Angke protected forest at the village of Kapuk Muara, Penjaringan sub district, North Jakarta has an area of 44.76 ha. This area located at 106˚43'-106˚48' east longitude and 6˚6'-6˚10' south latitude. Currently the Angke Kapuk Mangrove protected forest is experiencing ecological stress due to land and beach development (housing, trading, services, business and reclamation of coastal area). Meanwhile, the Mangrove community has an important role as a habitat for various types of fish, shrimp as a source of food for various species of birds. Based on this, regular monitoring needs to be done to determine the composition and diversity of the Avifauna there. Data collecting was design using transect method with 25 m observation radius on right and left transect. Each meet with bird, observer will stop for 15-20 minutes to identify. Observation were made in the morning between 06,30 to 09,30 AM. The results showed that there were 66 species and 34 family of birds. Species diversity index varies between 1.943and 3.302. In general, species diversity index of birds is relatively moderate. This research also showed that there is 6 protected bird species based on threat status (IUCN), 2 protected bird species based on trading (CITES) and 17 protected bird species based on Indonesian regulation. There is 6 species of migratory birds. Burung Gereja Erasia (*Passer montanus*) and Bondol Peking (*Lonchura punctulata*) are birds that have the highest relative abundance in several research locations.

Keywords : Avifauna, Bird, Mangrove protected forest Angke Kapuk, Muara Angke

I. INTRODUCTION

Angke protected forest at the village of Kapuk Muara, Penjaringan sub district, North Jakarta has an area of 44.76 ha. This area located at 106˚43'-106˚48' east longitude and 6˚6'-6˚10' south latitude. Its status as a protected forest with a width of 100-150 m is determined based on the Decree of the Governor of DKI Jakarta No. Ea15/1/13/70 (Atmawidjaja and Romimohtarto, 1998). The Mangrove forest area is very vulnerable with a high level of conversion and land exploitation due to development. Currently the Angke Kapuk Mangrove protected forest is experiencing ecological stress due to land and beach development (housing, trading, services, business and reclamation of coastal area). Meanwhile, the Mangrove community has an important role as a habitat for various types of fish, shrimp as a source of foodfor

various species of birds. Based on this, regular monitoring needs to be done to determine the composition and diversity of the Avifaunathere.

II. RESEARCH METHODS

A. Location and Time of Research

The study was conducted on 11 plots around the Angke Kapuk protected forest area, North Jakarta (Figure 1).

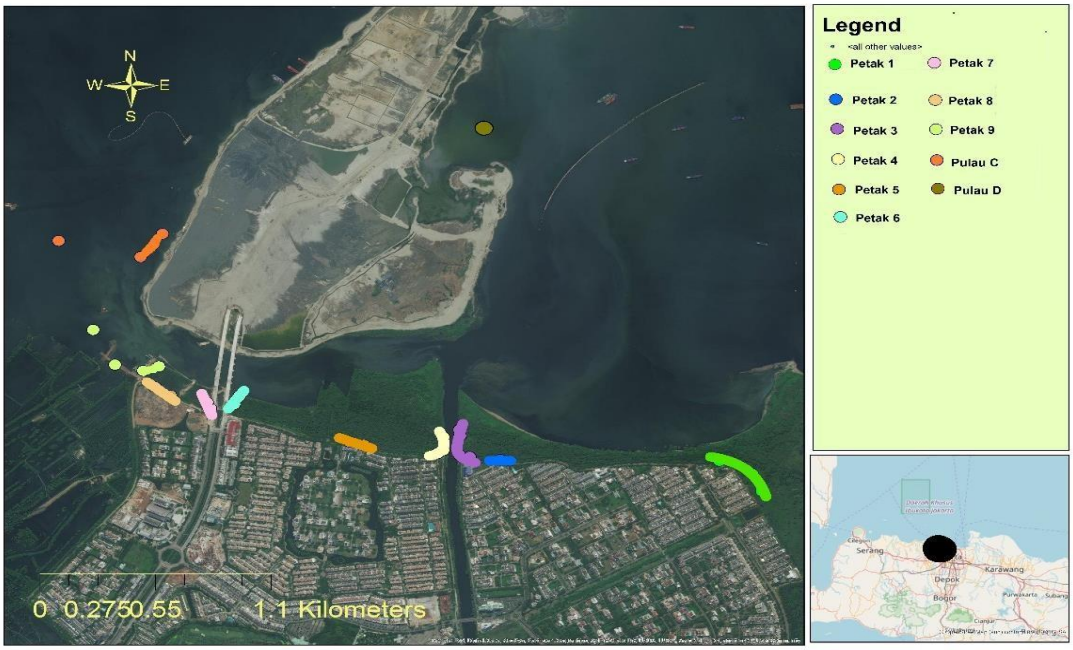

Figure 1. Map of the location of observation points in the Pantai Indah Kapuk area

B. Tools and Materials

Equipment and materials used in this study include stationery, pocket books, bird field guide books in Sumatera, Kalimantan, Java and Bali (Mackinnon et al, 2010), digital cameras, GPS, binoculars, digital clocks and counters.

C. Procedure

Data collecting was design using transect method with 25 m observation radius on right and left transect. Each meet with bird, observer will stop for 15-20 minutes to identify. Observation were made in the morning between 06,30 to 09,30 AM. The parameters observed were the time of the observer's encounter with each species of bird, types of birds found in each observation path, and calculation of the number of individuals of each species ofbird.

D. Data Analysis

(1) Speciescomposition

Species composition obtained based on species identification in each observation path. Data were analyzed descriptively.

(2) Shannon Wiener species diversityindex

To find out the diversity index of bird species according to Magurran (1988) can use the formula :

$$H' = -\sum Pi \, . \, \ln Pi$$

Note :

H' = Species diversity index

Pi = ni/N

ni = Number of individuals in species i

N = The number of individuals of all species

According to Kreb (1985) the criteria used to determine the value of species diversity index (H'), namely :

H'≤1 = low diversity

1<H'<3 = moderate diversity

H'>3 = highdiversity

(3)Relative Frequency (RF), Relative Abundance (RA) and Important Value Index (IVI)

$$\text{Individual frequency of a bird species (F)} = \frac{\text{Number of plots containing species i}}{\text{Total number of plots}}$$

$$RF = \frac{\text{Individual frequency of a bird Species}}{\text{The total frequency of all bird species}}$$

(4)Important value index (Fachrul,2012)

Important value index (IVI) = Relative Frequency (RF) + Relative Abundance (RA).

III. RESULTS AND DISCUSSION

A. Species Composition

The results showed that there were 66 species and 34 family of birds. The number of bird species found at each observation site can be seen in Figure 2.

Ardeidae family is a family that has the highest number of bird species with 11 bird species,namely : Cangak Abu (*Ardea cinerea*), Cangak Merah (*Ardea purpurea*), Kuntul Kerbau (*Bubulcus ibis*), Kuntul Besar (*Egretta alba*), Kuntul Perak (*Egretta intermedia*), Kuntul Kecil (*Egretta garzetta*), Kokokan Laut (*Butorides striata*), Blekok

Sawah (*Ardeola speciosa*), Kowak Malam Kelabu (*Nycticorax nycticorax*), Bambangan Kuning (*Ixobrychus sinensis*), dan Bambangan Merah (*Ixobrychus cinnamomeus*). Ardeidae family dominance is supported by the presence of Mangrove Forests, especially areas that have shallow water covered with low vegetation or no vegetation to look for their food.

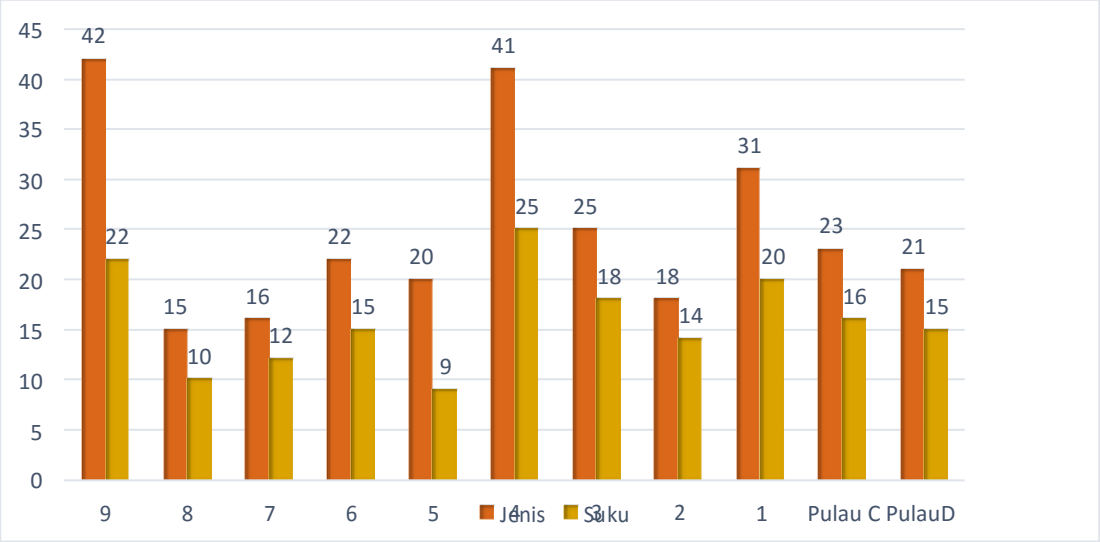

Figure 2. Comparison graph of the number of family and species of birds at 11 observartion locations

B. Species Diversity

Diversity index of bird species around Mangrove Forest Angke Kapuk can bee seen in Figure 3.

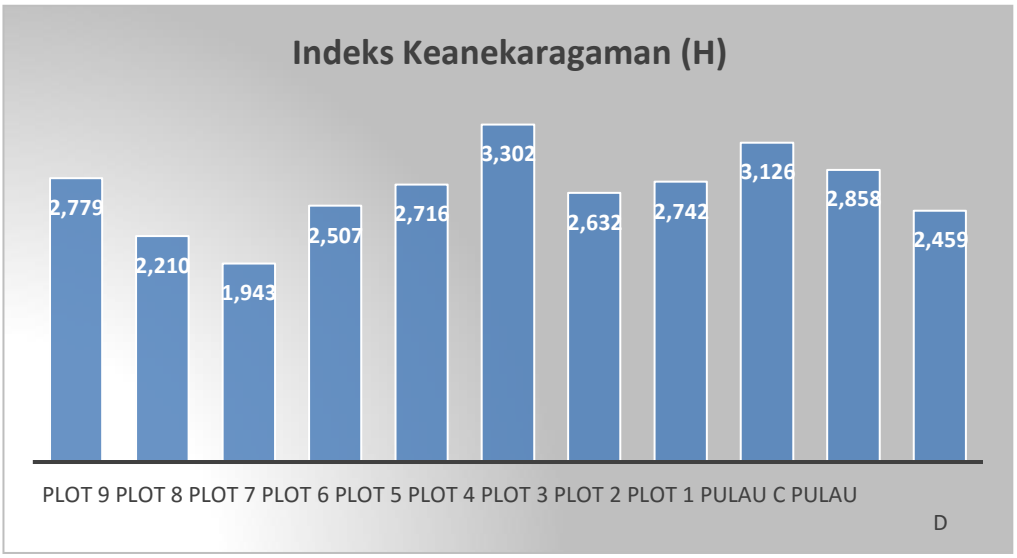

Figure 3. A comparison chart of the Shannon Wiener Species Diversity Index around the Angke Kapuk Mangrove Forest

The results of the species diversity index calculation at the observation site were in plot 4 (3.302), plot 1 (3.126), Island C (2.858), plot 9 (2.779), plot2 (2.742), plot 5 (2.716), plot 3 (2.632), plot 6 (2.507), Island D (2.459), plot 8 (2.210), and plot 7 (1.943). The highest diversity value was found in plot 4 (3.302) and plot 1 (3.126) which was classified as high level. This shows that the presence of bird species and supporting factors in that location is still very good. Diversity of bird species can differ from one habitat to another depending on the diversity of vegetation variation, diversity of food sources, shelter and water sources (Alikodra, 1990). Another factor that causes high biodiversity index values in plot 4 and plot 1 is that it is not close to human activity and away from noise sources. Plot 4 habitat is a combination of Mangrove Forest, standing water, and near the sea which provides abundant food such as insects, fruit, worms and fish. While plot 1 is a potensial protected forest area as a bird habitat for take food, resting andsheltering.

C. Important Value Index(IVI)

The highest Important Value Index of bird species in each observation plot can be seen in Table 1.

Table 1. The Highest Important Value of bird in each observation plot

Petak9			**Petak3**		
No	**Namajenis**	**INP**	**No**	**Namajenis**	**INP**
1	Bondolpeking	25.616	1	Bondolpeking	32.571
2	Gagang-bayamtimur	22.752	2	Cucakkutilang	13.890
3	Cerekjawa	11.293	3	Merbahcerukcuk	12.791
Petak8			4	Waletlichi	12.791
No	**Namajenis**	**INP**	**Petak2**		
1	Burunggerejaerasia	42.874	**No**	**Namajenis**	**INP**
2	Merbahcerukcuk	15.287	1	Cucakkutilang	18.713
3	Waletlichi	20.460	2	Remetuklaut	16.082
Petak7			3	Burunggerejaerasia	16.082
No	**Namajenis**	**INP**	**Petak1**		
1	Burunggerejaerasia	57.470	**No**	**Namajenis**	**INP**
2	Tekukurbiasa	12.348	1	Kareopadi	14.764
3	Waletlichi	12.348	2	Burunggerejaerasia	14.764
Petak6			3	Cucakkutilang	10.918
No	**Namajenis**	**INP**	**PulauC**		
1	Bondolpeking	30.861	**No**	**Namajenis**	**INP**
2	Waletlichi	19.458	1	Waletlichi	14.693
3	Blekoksawah	14.195	2	Kuntul kecil	14.200
Petak5			3	Cerekjawa	13.215
No	**Namajenis**	**INP**	**PulauD**		
1	Burunggerejaerasia	21.129	**No**	**Namajenis**	**INP**
2	Tekukurbiasa	16.290	1	Cerekkernyut	26.601
3	Cinenenkelabu	14.677	2	Itikbenjut	23.153
Petak4			3	Bondolpeking	16.831
No	**Namajenis**	**INP**			
1	Burunggerejaerasia	13.077			
2	Waletlichi	15.914			
3	Blekoksawah	10.950			

Species of birds that have the highest importance or dominance at the observation site are Erasia Sparrows (*Passer montanus*). This bird species dominates in plot 8, plot 7, plot 5, plot 1, and plot 4. This species lives in colonies and has a high adaptability to human life and has a wide spread or dispersal.

D. Bird Conservation Status

This research also showed that there is 6 protected bird species based on threat status (IUCN), 2 protected bird species based on trading (CITES) and 17 protected bird species based on Indonesian regulation (Table 2).

Table 2. Bird Conservation Status according to IUCN, CITES, laws and Indonesian Government Regulations

No	Nama Ilmiah	Nama Lokal	IUCN	CITES	UU,PP
1	*Anhinga melanogaster*	Pecuk-ular Asia	NT		A,B
2	*Fregata andrewsi*	Cikalang Christmas	CR	I	A,B
3	*Ardea cinerea*	Cangak abu			A,B
4	*Ardea purpurea*	Cangak merah			A,B
5	*Bubulcus ibis*	Kuntul kerbau			A,B
6	*Egretta alba*	Kuntul besar			A,B
7	*Egretta intermedia*	Kuntul perak			A,B
8	*Egretta garzetta*	Kuntul kecil			A,B
9	*Mycteria cinerea*	Bangau bluwok	EN	I	A,B
10	*Anas gibberifrons*	Itik benjut	NT		
11	*Charadrius javanicus*	Cerek jawa	NT		
12	*Numenius phaeopus*	Gajahan penggala			B
13	*Chlidonias hybrid*	Dara laut kumis			A,B
14	*Alcedo coerulens*	Raja-udang biru			A,B
15	*Todirhamphus chloris*	Cekakak sungai			A,B
16	*Todirhamphus sanctus*	Cekakak suci			A,B
17	*Rhipidura javanica*	Kipasan belang			A,B
18	*Anthreptes malacensis*	Burung madu kelapa			A,B
19	*Cinnyris jugularis*	Burung-madu sriganti			A,B
20	*Lonchura oryzivora*	Gelatik batu	VU		

Thera are 6 species of birds protected by threatened status (IUCN), 2 species protected by trade status (CITES), and 17 species of protected birds (laws and regulations of the government of the Republic of Indonesia). Species of birds that have a threat status (IUCN) are: Cikalang Christmas (*Fregata andrewsi*) which is very endangered species (critically endangered), Bangau Bluwok (*Mycteria cinerea*) endangered status, Gelatik Kelabu (Lonchura oryzivora) vulnerable species, Itik Benjut (*Anas gibberifrons*), Pecuk Ular Asia (*Anhinga melanogaster*), and Cerek Jawa (*Charadrius javanicus*) with near threatened species status. The Angke Kapuk Mangrove protected area has many species of birds protected nationallyand

internationally. This show that the area around the Angke Kapuk Mangrove protected forest is a habitat that supports the lives of various species of birds currently threatened with extinction. Therefore, its existence must be maintained, replanting mangrove, regularly cleaning garbage, periodic monitoring, raising public awareness, and controlling water pollution and rubbish originating from the mainland (land based pollution).

E. Migratory Birds

Based on observations results 6 migratory bird species were found in several location, namely : Gagang Bayam Timur (Himantopus leucocephalus), Cerek Kernyut (Pluvialis fulva), Gajahan Penggala (Numenius phaeopusi), Cikalang Christmas (Fregata andrewsi), Trinil Semak (Trinsga glareola), and Dara Laut Kumis (Chlidonias hybrid). The area around Angke Kapuk Mangrove Protection Forest is an important area where migratory birds stay for a place to rest and look for food (Feeding Ground) and must be maintained its existence.

IV. CONCLUSION

Based on the results of the study can be concluded as follows:

1. The composition of bird species around the Angke Kapuk Mangrove protected forest consists of 66 species of birds from 34families.
2. Erasia Sparrow (*Passer montanus*) and Peking Bondol *(Lonchura punctulata*) a re the dominant bird species found in several observationlocations.
3. There are 6 bird species protected based on threat status (IUCN), 2 bird species protected based on trade status (CITES), and 17 bird species with protection status in Indonesia.
4. There are 6 species of migratory birds recorded, namely : Cerek Kernyut (*Pluvialis fulva*), Gajahan Penggala (*Numenius phaeopusi*), Trinil Semak (*Tringa glareola*), Gagang Bayam Timur (*Himantopus leucocephalus*), Dara Laut Kumis (*Chlidonias hybrid*), and Cikalang Christmas (*Fregataandrewsi*).

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Undang undang Republik Indonesia Nomor 5 Tahun 1990 tentang Konservasi Sumberdaya Alam Hayati dan ekosistemnya

A COMPARATIVE PERSPECTIVE ON ORANGUTANS (*Pongo pygmaeus*) AS SEED DISPERSERS

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Abstract

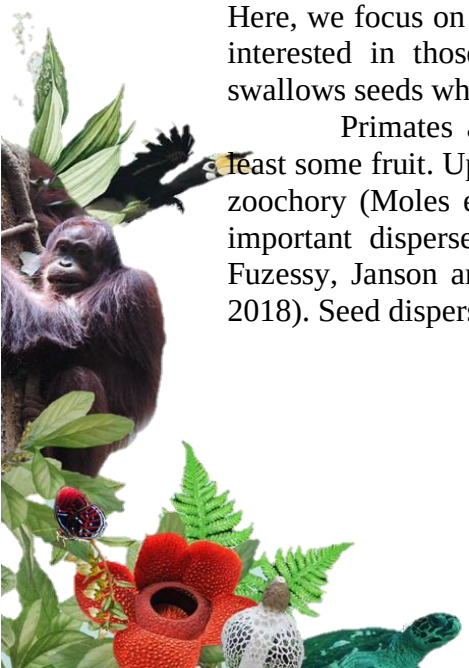
Seed dispersal is a process essential for the maintenance and regeneration of tropical forests. Many primates are important seed dispersers, and orangutans are predicted to be important seed dispersers as they are large-bodied and highly frugivorous. However, minimal previous research has been conducted on orangutan seed dispersal behavior. Here, we present our preliminary analyses on orangutan seed dispersal behavior. Our data were collected in Gunung Palung National Park in West Kalimantan from August 2018 to August 2019. We collected 549 wild Bornean orangutan fecal samples, of which 74.2% of the fecal samples contained intact seeds. Dispersed seeds ranged in length from 0.1mm to 32.5mm. Next, we used a comparative perspective to understand orangutan seed dispersal effectiveness by placing orangutans in the context of the other apes. Orangutans disperse seeds with similar frequency as some populations of chimpanzees and gorillas. Overall, orangutans appear to be effective seed dispersers based on quantitative seed dispersal measures. We advocate for the conservation of wild orangutans as they have a vital ecological role as seed dispersers in tropical forests.

Keywords: Orangutans, Seed Dispersal, Ecology, Apes

I. INTRODUCTION

Seed dispersal is the movement of seeds out from underneath the parent tree, an area of high seed mortality, to a new location often suitable for seed germination and seedling establishment. There are various types of seed dispersal processes, some plant species rely on abiotic vectors for dispersal such as wind, water, or gravity, whereas other plant species require a biotic vector for dispersal (Herrera and Pellmyr, 2002). Here, we focus on seed dispersal via animals, known as zoochory. In particular, we are interested in those seeds which are dispersed when an animal consumes a fruit, swallows seeds whole, and defecates viable seeds, known asendozoochory.

Primates are primarily located in the tropics and most primates consume at least some fruit. Up to 60% of woody trees in the tropics produce fruits for dispersal via zoochory (Moles et al., 2007). Thus, as many primates are frugivorous, primates are important dispersers of tropical seeds (Fuzessy et al., 2016; Estrada et al., 2017; Fuzessy, Janson and Silveira, 2017; Andresen, Arroyo-Rodríguez and Ramos-Robles, 2018). Seed dispersal moves seeds out from underneath the parent tree, which is anarea



of high seed mortality, to new location often suitable for seed germination and establishment. Primates comprise from 25% to 40% of the frugivore biomass in the tropics, and therefore primates may be dispersing larger quantities of seeds relative to other dispersal guilds (Chapman, 1995). See dispersal by primates may be especially important for plant species with large-size seeds or hard-husked fruits. Primates have dexterous hands, and large gape-width, allowing them to disperse these fruits, which small-bodied dispersers cannot. Therefore, primate dispersal may be especially important for these fruits, that are inaccessible to many other dispersers (Corlett and Lucas, 1990; Jordano, 2000; Corlett, 2007) Overall, plant regeneration and recruitment in the tropics is likely shaped by primate seed dispersal.

Apes are increasingly recognized as important seed dispersers because of their large body size and seed handling behaviors. Apes have longer gut passage rates, longer seed dispersal distances, swallow larger seeds, and consume larger quantities of seeds than most other primates (Galdikas, 1982; Wrangham, Chapman and Chapman, 1994; Gross-Camp and Kaplin, 2011; Trolliet et al., 2016; Haurez et al., 2017; Tarszisz et al., 2018). Additionally, the great apes are larger in body size than monkeys and strepsirhines and thus, can consume more seeds in a single feeding bout at a given time. Poulsen et al., (2001) studied the seed dispersal behavior of sympatric primates in Cameroon, and found that chimpanzees and gorillas, dispersed over half of the seeds that all the primates in that forest disperse. Overall, apes have a significant role in dispersing seeds, particularly influencing the fate of large-seeded plants (Voysey et al., 1999; Gross-Camp and Kaplin, 2011).

Orangutans are highly frugivorous, consuming fruit almost every day (Knott, 1998). Earlier studies suggested that orangutans frequently disperse seeds, as seeds were present in 71-94% of all fecal samples. Additionally, in germination experiments, orangutan gut-passed seeds have been shown to be viable and germinate after passage (Nielsen et al., 2011; Tarszisz et al., 2018). Furthermore, orangutans travel extensive distances each day (approximately 800-1000m per day) and thus, orangutans may be moving seeds long distances from the parent tree (Galdikas, 1982; Harrison, 2009). Our study on orangutan seed dispersal behavior builds on previous research, however in contrast to previous studies it represents a long-time frame (1 year) and samples from a large number of orangutans (more than 20 individuals). We predicted that orangutans in Gunung Palung National Park are 1) dispersing large quantities of seeds, 2) dispersing a wide diversity of species and genera, and 3) are important seed dispersers, essential to the maintenance and regeneration of the tropical forests they inhabit.

II. RESEARCH METHODS

A. Study area

This study was conducted at the Cabang Panti Research Station in Gunung Palung National Park (GPNP), located in West Kalimantan, Indonesia. This site (10 13’S, 1100 p7’E) is a primary tropical rain forest, which is comprised of a mosaic of eight habitats types (Setiawan, 2015). GPNP contains a population of at least 2500 Bornean wild orangutans (*Pongo pygmaeus wurmbii*) (Johnson et al., 2005).

B. Procedures

Data on orangutan seed dispersal behavior were collected from August 2018 to August 2019. Seed dispersal data were collected on all age-sex classes of orangutans, excluding infants that did not produce fecal samples that could be collected. Long-term behavioral data were collected from January 2013 to August 2019. A focal orangutan was observed continuously from when it left the morning nest until it entered a night nest for up to ten consecutive days. Behavioral data were collected for each focal orangutan following standardized data collection protocols.

Orangutan fecal samples were systematically collected during orangutan follows using gloves and plastic bags while wearing a mask. We collected as much of each fecal sample as was possible, and estimated the percentage of the entire defecation that each sample represented. Fecal samples were brought to the field station for processing. At the field station, fecal samples were sieved through a 2mm sieve in order to find all the intact seeds larger than 2mm. The seeds (>2mm) were counted and almost all seeds were identified to the genus level. The length and width of a subsample of seeds were measured. Photographs were taken of fruits and seeds consumed by the orangutan during the focal follow to assist with seed identification. Seeds smaller than 2mm, from genera such as *Ficus* and *Pternandra*, were not counted individually. Instead we estimated the number of small seeds present using intervals (0-10, 10-100, 100-1000,1000+).

C. Data Analysis

We calculated the mean number of seeds (larger than 2mm) and the mean number of genera per fecal sample, for fecal samples where we felt confident that over 85% of the sample had been collected (n=266). Long-term behavioral data collected between January 2013 and August 2019 were used to calculate the mean number of defecations per adult orangutan per day (adult female defecations n= 1752, flanged male defecations n= 314, unflanged male defecations n= 157). All statistics and analyses were conducted in R (R Development Core Team, 2015, version3.5.2.).

III. RESULTS AND DISCUSSION

Throughout the study period 549 fecal samples were collected from 36 different orangutans. Seeds were found in 413 samples (75.2%) of the 549 fecal samples collected. All age-sex classes of orangutans dispersed seeds (excluding infants that did not produce fecal samples that could be collected). Throughout the study, orangutans dispersed 24 genera of fruit. Orangutans dispersed a mean of 1.17 genera per fecal sample (SD= 0.95, range 0-7 genera, n=266) and a mean of 33 ± 6.2 [2 SD] seeds (largerthan2mm)perfecalsample(range0-395seeds,n=266),see*Figure1*.Adult

orangutans defecated a median of 3 times per day, thus we estimate that each adult orangutan defecates approximately 99 seeds (>2mm) per day per individual. The largest seed dispersed by orangutans was a *Gluta* spp. seed, measuring 32.5mm in length and 21.5mm in width.

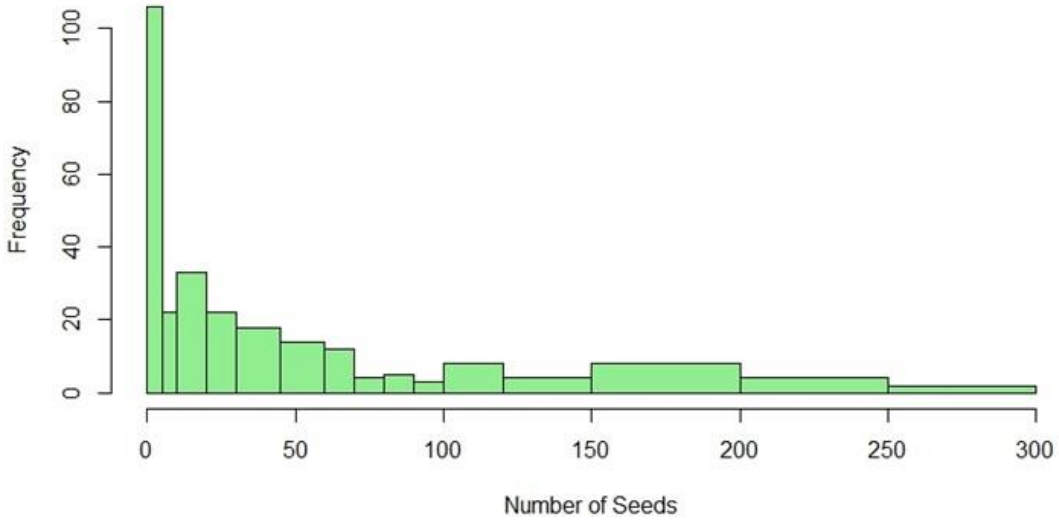


Figure 1. The number of seeds per orangutan fecal sample. (n=266)

Our next objective was to understand orangutan seed dispersal behavior by using a comparative context. Our orangutan seed dispersal results are compared to those of the other ape species in Table 1. We found that orangutan seed dispersal behavior is similar to the seed dispersal behavior recorded for other ape populations, with values falling in the intermediate range. For example, the largest seed dispersed by orangutans was 32.5mm in length, which is longer than the maximum seed size recorded for chimpanzees, but notably smaller than the maximum seed size recorded for gibbons, bonobos, and gorillas (Wrangham, Chapman and Chapman, 1994; McConkey, 2000; Petre et al., 2015; Trolliet et al., 2016). This is particularly interesting as gibbons are much smaller in body size than orangutans and chimpanzees. The percentage of orangutan fecal samples with seeds, 75.2%, is strikingly similar to the percentage recorded for some gorilla and chimpanzee populations, 73.6 to 74.2%, respectively (Poulsen, Clark and Smith, 2001). However, orangutans defecate seeds less often than recorded for gibbons and bonobos. Gibbons and bonobos defecate seeds in almost all fecal samples (99 to 100% of fecal samples) (McConkey, 2000; Trolliet et al., 2016). In all, orangutans appear to be effective seed dispersers and quantitative measures of orangutan seed dispersal are similar to that of other apes.

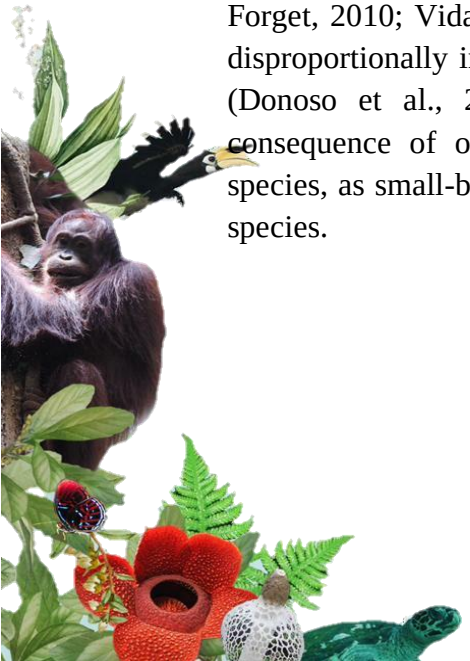
Table 1. A comparison of orangutan seed dispersal metrics with the other apes. All studies cited were conducted for at least ten months. (n: the number of fecal samples analyzed in each study)

	Gibbon	Gorillas	Chimpanzees	Bonobos	Orangutans
Largest Seed Size Dispersed (Length)	42.0mm (McConkey, 2000)	53mm (Petre *et al.*, 2015)	27.4mm (Wrangham, Chapman and Chapman, 1994)	40mm (Trolliet *et al.*, 2016)	32.5mm
Percent Fecal samples with seeds	100% (n= 165) (McConkey, 2000)	73.6% (n=87) to 98% (n=180) (Poulsen, Clark and Smith, 2001; Haurez *et al.*, 2017)	74.2% (n=178) to 98.5% (n= 1849) (Wrangham, Chapman and Chapman, 1994; Poulsen, Clark and Smith, 2001)	99.4% (n=2252) (Trolliet *et al.*, 2016)	75.2% (n=266)
Mean number of seeds per fecal sample	6.8 (>3mm) (McConkey, 2000)	40.8 (>2mm) to 58 (≥5mm) (Poulsen, Clark and Smith, 2001; Haurez *et al.*, 2017)	18 (>2mm) to 37 (>5mm) (Lambert, 1999; Poulsen, Clark and Smith, 2001)		33 (>2mm)
Mean number of species of seeds per fecal sample	2.2 (McConkey, 2000)	1.7 to 2.4 (Poulsen, Clark and Smith, 2001; Haurez *et al.*, 2017)	1.7 to 2.8 (Wrangham, Chapman and Chapman, 1994; Poulsen, Clark and Smith,2001)	2.3 (Trolliet *et al.*, 2016)	1.17 *Number of genera, not species

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

Overall, Bornean orangutans disperse a wide diversity of plants and a large quantity of seeds each day. Bornean orangutan seed dispersal metrics fall within the seed dispersal metrics measured for other ape species, suggesting orangutans are also important seed dispersers. Loss of a large-bodied frugivore, such as the orangutan, could alter forest regeneration and maintenance processes (Vanthomme, Bellé and Forget, 2010; Vidal, Pires and Guimarães, 2013). Large-bodied frugivores likely have disproportionally important roles in ecosystem functions, such as seedling recruitment (Donoso et al., 2017). Orangutans disperse large seeds (up to 32mm), thus a consequence of orangutan extirpation may be dispersal limitation of large-seeded species, as small-bodied sympatric frugivores may not be able to disperse large-seeded species.



B. Recommendations

Our study has shown orangutans frequently disperse seeds, but we do not know orangutan post-dispersal seed fate, and thus, we suggest this as an avenue for future research. By understanding post-dispersal seed fate we can measure the quality of orangutan seed dispersal (Schupp, Jordano and Gomez, 2010). Another recommendation for a follow-up study is to test the germinability of orangutan gut-passed seeds and compare orangutan seed germinability with control seeds and fruits. Germination experiments would elucidate how orangutan dispersal affects seed germinability, whether through the processes of deinhibition or scarification (Robertson et al., 2006). A future research direction is to combine measures of both seed dispersal quantity and quality using the seed dispersal effectiveness framework in order to understand the complexities of orangutan seed dispersal (Schupp, Jordano and Gomez, 2010). Combining orangutan seed dispersal quantity and quality would allow for identifying which plant species are most effectively dispersed by orangutans. Finally, as orangutans are critically endangered, yet occupy a critical seed dispersal role Bornean and Sumatran rainforests, we recommend ensuring theirconservation.

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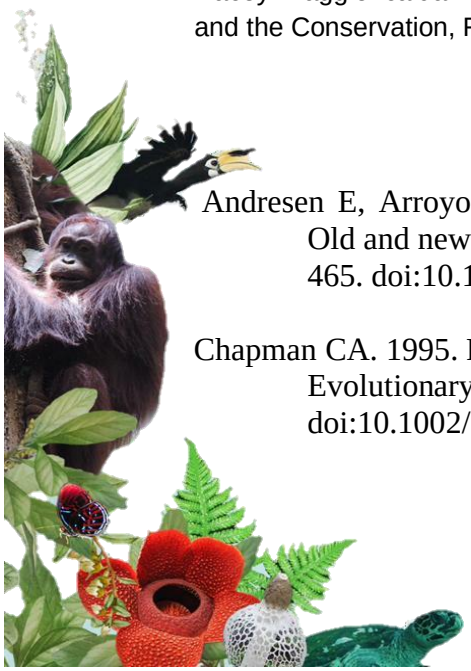

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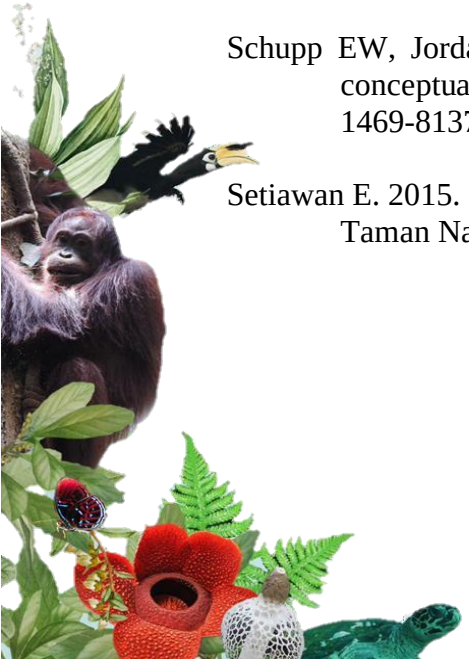

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BIRD SPECIES DIVERSITY IN VARIOUS HABITAT TYPES IN THE NATURE RESERVE AND PATENGAN NATURE TOURISM PARK, BANDUNG, WEST JAWA

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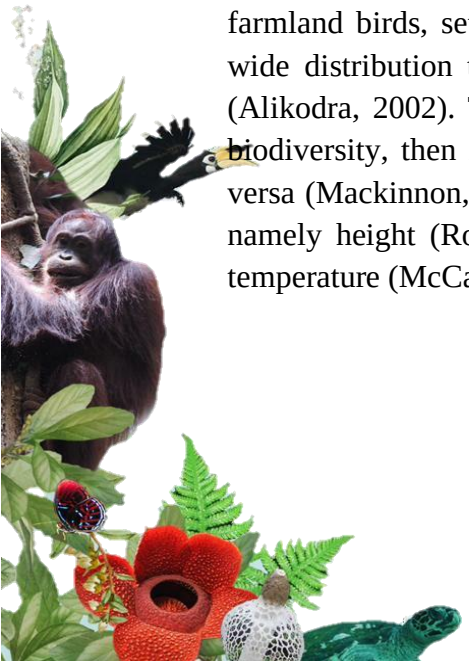
Abstract

Birds are one type of animal that has a high level of diversity. Indonesia, which has a variety of habitat types, is very supportive for various types of bird life. The Nature Reserve (CA) and Patengan Nature Tourism Park (TWA), Bandung, West Java is one of the areas that have bird species diversity potential, but until now, information about the diversity of birds in the area is still small. Therefore this study aims to determine the comparison of composition, diversity of bird species and see differences based on feed in various habitat types in the CA and TWA Patengan areas. The research took place on 1-3 September 2019. Data collection was carried out by recording bird species that were seen using the point count method. The results of the study were recorded as many as 70 species, 9 of which entered into the protection status based on Law Numb. 106 of 2018, 4 species are included in CITES Appendix II, and 3 species are incluced on the status of threat in the IUCN. Based on Shannonwiener diversity index calculation it is known that each habitat type has moderate diversity with a value between 2,038-2,926. And the most common birds are insectivorous birds with a percentage value of 72%.

Keywords: Bird diversity, Patengan Nature Reserve and Nature Tourism Park, Habitat, Guild

I. INTRODUCTION

In 2019, bird species increased from 1,666 to 1,777 species, of which birds can be found throughout Indonesia. Birds are wild animals which are grouped based on several types of habitats, namely: forest birds, birds in open areas (open forest birds), farmland birds, settlement birds, air birds (water) birds (Kurnia, 2003). Birds have a wide distribution that is moved by a wide area, altitude, and geographical location (Alikodra, 2002). This, makes birds as bioindicators of an area, if the area has more biodiversity, then it can be said that the area has good habitat / ecosystem, and vice versa (Mackinnon, 2010). There are several factors that affect various species of birds, namely height (Rodrigues et al., 2010), vegetation diversity (Joshi et al., 2012) and temperature (McCain,2009).



Patengan Nature Reserve (CA) and Patengan Nature Tourism (TWA) are areas that belong to Patengan Village, Rancasari District, Bandung Regency, West Java Province with a wavy topography with a slope angle of 5 - 30% (average to steep) at altitudes of 1,600 - 1,700 m asl. Patengan CA and TWA areas have an ecosystem consisting of heterogeneous forests, rasamala forests and tea plantations. Some vegetation variations are there including Puspa (Schima walichii), Rasamala (Altingia excelsa), Kibodak / kibadak, Banyan, Huru, bush, kirenyu, eucalyptus, hiur, songo wali, wuru, jengjen, kalimorot, tide, salamander , and Krinyu. This allows for the diversity of species found in CA and TWA Patengan. Research on variations in bird species in various communities, has been conducted in several locations. Based on Setiawan's (2013) research on the diversity of bird species in several high places in the natural forest area of Ciwidey Regency, Bandung, there are 50 species of birds found with a diversity index value (H') ranging between 2.92-3.43 and the species that are often found are Pericrocotus miniatus, Zosterops sp. Then use more strata found in header B released by insectivorousbirds.

Based on this background, this study aims to study the composition of birds and see bird species based on feed in various habitat types in the CA and TWA Patenganareas.

II. RESEARCH METHODS

A. Research time andplace

This research was conducted on 1-3 September 2019 in Patengan Nature Reserve and Nature Tourism Park, Bandung, West Java. Data is collected on existing tracks and differentiated by habitat type (Fig. 1).

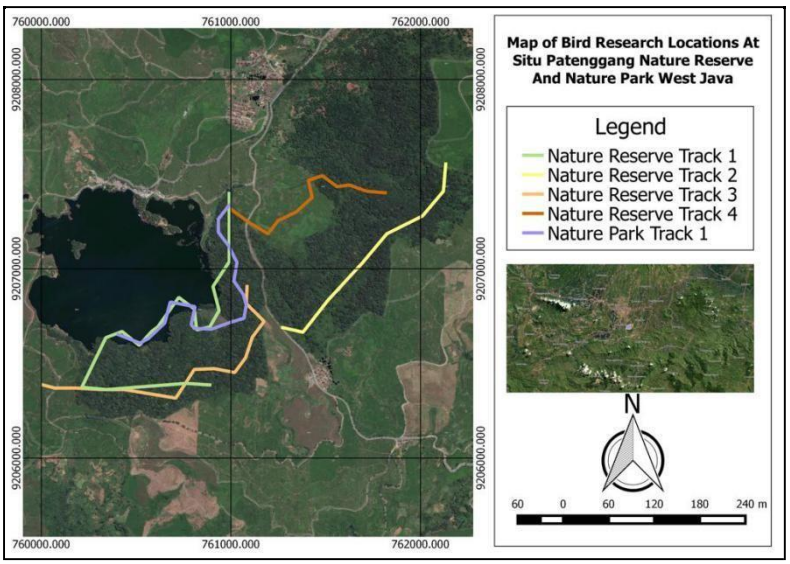


Fig. 1. Research Map in TWA and CA Regions Patengan, Bandung, West Java

B. Research instrument

The equipment used in this study was binoculars, digital cameras, stationery, notebooks, digital watches, GPS and field manuals (The Bird's Field Guide Series in Sumatra, Java, Bali and Kalimantan by MacKinnon and Philips, 2010).

C. Data retrieval

Observations were carried out twice, consisting of morning observations at 07.00-10.00 and afternoon at 14.00-17.00, the method used was the point count method following a predetermined path. The length of the path along 1 km by means of pengataman for ± 15 minutes at intervals between 100 m with the observation radius right and left as far as 25 meters. Things to note include the time of encounter, species of bird, number of individuals, andactivity.

D. Data analysis

1. Type composition

Species composition is an arrangement and the number of species in an area, to determine the composition underlying the presence or absence of a relationship between the number of species that are common in the two community areas and the total species.

2. Species diversity indeks

To find out the diversity of bird species. In the calculation of species diversity index values determined by the Shannon-Weaner index with the following equation:

$$H' = -\sum pi \ln pi$$

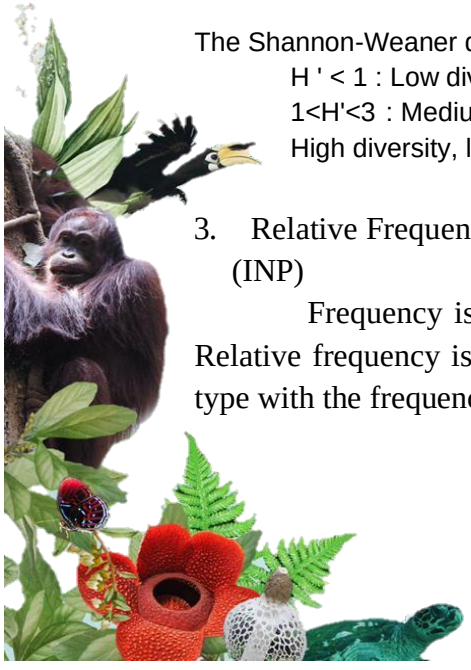
$$Pi = \frac{ni}{N}$$

Note: H '= Species DiversityIndex
Pi = Proportion of i-th importance
ln = natural logarithm
ni = Number of individuals in type 1
N = Number of individuals of all types

The Shannon-Weaner diversity index range is as follows (Fachrul,2012):
H ' < 1 : Low diversity, high ecologicalpressure
1<H'<3 : Medium diversity, moderate ecologicalpressure H'>3 : High diversity, low ecologicalpressure

3. Relative Frequency (FR), Relative Abundance (KR) and Important Value Index (INP)

Frequency is a quantity that indicates the level of encounter in a community. Relative frequency is obtained from the comparison between the frequency value of a type with the frequency value of all types. The value of frequency (F) and relative



frequency (FR) of each bird species in each observation location can be calculated using the formula (Fachrul, 2012) as follows:

$$F = \frac{\text{Jumlah plot yang berisi i}}{\text{Jumlah total plot}}$$

$$FR = \frac{\text{Frekuensi individu suatu jenis burung}}{\text{Total frekuensi seluruh jenis burung}} x100\%$$

Abundance shows the number of individuals of the types that belong to a community. Relative abundance is calculated by dividing the abundance of one species by the abundance of all types. The value of abundance (K) and relative abundance (KR) of each bird species in each observation location can be calculated using the formula (Fachrul, 2012) as follows:

$$K = \frac{\text{Jumlah individu suatu jenis pada setiap lokasi}}{\text{Jumlah total individu}} KR$$

$$= \frac{\text{Kelimpahan individu suatu jenis}}{\text{Jumlah kelimpahan seluruh jenis}} x100\%$$

Important value index is a quantitative parameter that can be used to express the level of species dominance of the bird community. Value Index Important value (INP) can be calculated by the formula (Fachrul,2012):

INP = FR + KR

Note: FR = relative frequency

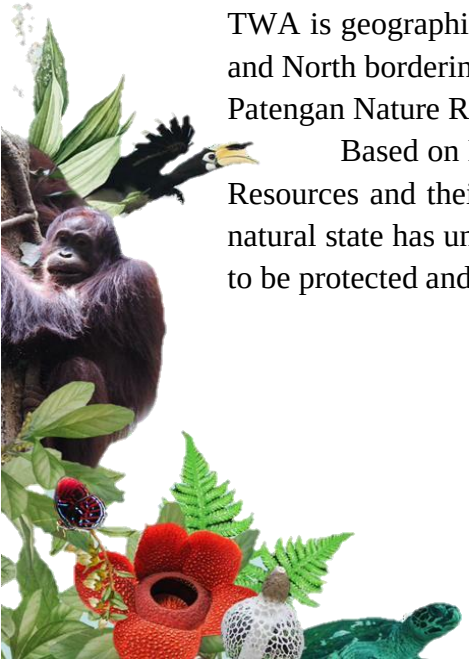
KR = relative abundance

III. RESULTS AND DISCUSSION

A. Habitat Conditions

Patengan Nature Tourism Park (TWA) is one of the natural tourism areas managed by the Bandung Natural Resources Conservation Center (BKSDA) and in collaboration with private companies. Situ Patengan TWA is located in Patengan Village, Rancabali District, Bandung Regency, West Java Province. Situ Patengan TWA is geographically located between the boundaries of the region, namely the West and North bordering PTPN VIII's Rancabali tea plantation, the South and East bordering Patengan Nature Reserve(CA).

Based on Law No.5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems, a Nature Reserve is a nature reserve area because its natural state has unique plants, animals, and ecosystems or certain ecosystems that need to be protected and their development takes place naturally. Whereas the Nature



Tourism Park is a nature conservation area with the main objective to be utilized for the benefit of tourism and nature recreation.

Data was collected in five paths representing the TWA and CA Regions. The CA area is divided into 2 blocks namely CA I and CA II. Based on the map (Figure 1) included in CA I are tracks 1 and 3 while CA II are tracks 2 and 4. CA I and TWA areas are heterogeneous forests while CA II is ecotone (Fig. 2). The Ecoton area is the border between the tea plantations and the homogenous Rasamala forest (Altingia excelsa Noronha).

a **B** **c**

Fig. 2. Heterogeneous forest habitat (a) CA I (b) TWA, Ecotone habitat (c) CA II

B. Type Composition

The results of the study carried out on five pathways belonging to two habitat types in the TWA and CA Patengang areas obtained as many as 70 species of birds from 29 tribes of 49 genera (Appendix 1). The number of bird species found in heterogeneous forest habitat, namely as many as 66 species of birds from 28 tribes, while in the ecotone habitat the number of bird species found was 24 species of birds from 19 tribes (Table1).

Table 1. Number of species, genera and ethnicity in two habitats in the CA dan TWA Patengan conservation area

Habitat	Family	Genus	Species
Heterogenous	28	56	66
Ekoton	16	18	24

Based on the results obtained, the number of birds is mostly found in heterogeneous forests. Nearly all the paths observed were included in heterogeneous forest types with varied vegetation. This allows for many encounters with birds. Vegetation is used by birds as habitat for nesting, resting, foraging, breeding and more. Habitat diversity influences bird species diversity (Crozier and Niemi 2003; Davidar et

al. 2001; Welty, 1982). The more diverse plants and their vegetation, the greater the diversity of animals, one of which is birds.

Based on the results of the study, of the 70 species of birds found 9 of them entered into protection status based on PP No. 106 of 2018 concerning protected plant and animal species, 4 species are included in the CITES Appendix II (Convention on International Trade in Endangered Species of Wild Fauna and Flora) which means the species is threatened with extinction if trade continues without regulation, and 3 species are included IUCN (International Union for Conservation of Nature) based on the status of its threat in nature.

C. Diversity of bird species

The diversity of bird species in a place is much influenced by the diversity of habitat and habitat quality itself and will affect differences in the number and species of birds (Lack, 1971). In addition, differences in diversity can occur due to differences in the structure of vegetation in each habitat type, so that it will cause a variety of food sources in a habitat (Alikondra, 1990).

Based on research that has been done, obtained 70 species of birds from 29 tribes in the five research pathways which are grouped into two habitats namely heterogeneous and ecotone forests. Each lane one to lane five worth 2,653, 2,038, 2,635, 2,163 and 3,052. Heterogeneous forest habitat is located in lane 1, 3 and 5 for CA I and TWA, while lines 2 and 4 are CA II area which is an ecoton habitat.

In CA areas both heterogeneous and ecotone forests have moderate biodiversity values, whereas in TWA areas diversity shows high values. The difference in value is possible due to differences in canopy cover on the vegetation of each lane. Canopy openness will affect the number of bird species found, the more canopy cover is opened, the more birds will be found compared to the densely closed canopy habitat (Wisnubudi, 2009).

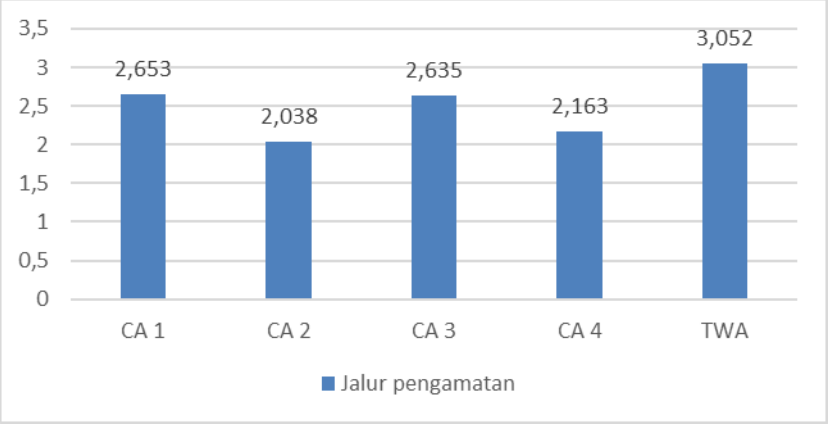


Fig 3. Diversity Value of Each Observation Line

D. Domination of Bird Species

Based on the results of observations, Swallow linci (Collocalia linchi) is a bird species that has the highest percentage in two types of habitat in the five observation paths. These results are calculations from the INP (Important Value Index) which is used to see the type of bird that dominates in ahabitat.

Detailed swallow (Collocalia linchi) is a bird that is able to adapt quickly to new environments. According to Adil et al. (2010) the higher the dominance of a type within a community, it shows the limits of broad adaptability and tolerance. In addition, the availability of feed in the form of abundant insects, the lack of competition, the opening of land to support life, as well as suitable habitats such as tree canopy, forest edges, and plantations for the continuity of its activities.

E. Grouping birds by type of feed (Feeding guilds)

Birds are species that actively move or fly from one location to another with a relatively long range. They can immediately search for food elsewhere, if the habitat conditions in their original location decline or are not in line with their expectations. They move to a preferred place, many sources of food, whether in the form of insects, fruit, seeds, and nectar. Locations with diverse vegetation support the availability and diversity of feed. Diverse vegetation allows birds to get a wider choice of feed types (Tews et al. 2004).

Based on the type of feed birds are grouped into six types, namely meat-eating birds (K = Carnivores), fruit-eating birds (F = Frugivores), seed-eating birds (G = Granivores), honey-eating birds or nectars (N = Nectarivora)), insectivorous birds (I = Insectivorous) and fish-eating birds (Fi = Piscivores) (Mackinnon et al. 2010). The diversity of feed is what makes birds not only grouped on one type of feed. For example, only insectivorous birds and nectarivores. Birds can have a mixture of both types of feed. Rumblat et al. (2016) call this group of birds a mixed feedeater.

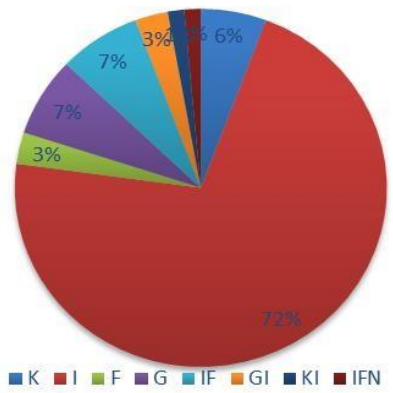


Fig 4. Results of percentage of birds based on their feed

Insectivorous birds predominate in all pathways at the study site. The percentage of bird feed that dominates is 72%. The high percentage of insectivorous birds is caused by the abundance of insects in both habitats. Insects can be found in various layers of vegetation or parts of plants such as in flowers, leaves, twigs, and stems. Therefore insects can be used as the main feed or alternative feed from birds, if other main feeds are not available (Pratasasmita et al. 2009).

IV. CONCLUSIONS AND RECOMMENDATION

A. Conclusion

Based on the description above, the following conclusions can be drawn:

1. The number of bird species found is as many as 70 species from 29 tribes in two habitat types namely heterogeneous andecotone
2. Diversity of bird species in heterogeneous habitat types has the highest value of 3,052, namely in the Patengan TWA catchment path. While diversity in track 4 track which is an ecotone habitat has a value of 2,163 in the CA IIarea.
3. Swallow linchi (Collocalia linchi) is a type of bird that dominates in two habitats.
4. Birds with insectivorous feed species are the most commonly found in two types of habitats with a percentage value of72%.

B. Suggestions

1. Periodic monitoring of the same area isneeded
2. Related to the diversity of bird species, it is necessary to manage the area that takes into account the preservation of bird species diversity and diversity of vegetationspecies.

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Thank you to those who helped during the data collection process in the field until the completion of this writing. To the Head of West Java BBKSDA Ir. Ammy Nurwati, M.M. To Dr. Tatang Mitra Setia, M.Sc as the coach of BBC "Ardea" Faculty of Biology, National University of Jakarta. To Saca Taopik who helped during the data collection process in the field.

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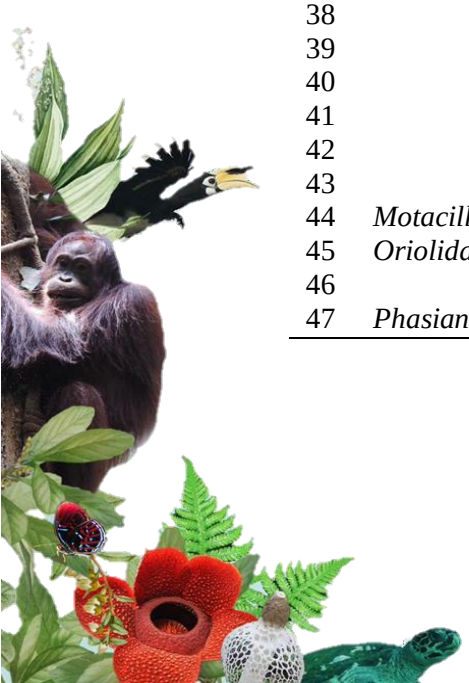
Appendix Table 1. Bird species found in Patengan CA and TWA Areas

No	Family	Scientific name	Bird species
1	*Accipitridae*	*Ictinaetus malayensis*	Elang hitam
2		*Nisaetus bartelsi*	Elang jawa
3		*Spilornis cheela*	Elang-ular bido
4	*Aegithinidae*	*Aegithina tiphia*	Cipoh kacat
5	*Alcedinidae*	*Alcedo meninting*	Raja-udang Meninting
6		*Halcyon chloris*	Cekakak sungai
7		*Halcyon cyanoventris*	Cekakak jawa
8	*Apodidae*	*Apus nipalensis*	Kapinis rumah
9		*Collocalia linchi*	Walet linci
10	*Campephagidae*	*Coracina lavarta*	Kepudang sungu gunung
11		*Hemipus hirundinaceus*	Jingjing batu
12		*Pericrocotus cinnamomeus*	Sepah kecil
13		*Pericrocotus flammeus*	Sepah hutan
14		*Pericrocotus miniatus*	Sepah gunung
15	*Capitonidae*	*Megalaima armillaris*	Takur Tohtor
16		*Megalaima australis*	Takur tenggeret
17	*Cettiidae*	*Cettia vulcania*	Ceret gunung
18	*Cuculidae*	*Cacomantis merulinus*	Wiwik kelabu
19		*Cacomantis sepulcralis*	Wiwik uncuing
20		*Eudynamys scolopaceus*	Tuwur asia
21		*Rhamphococcyx curvirostris*	Kadalan Birah
22	*Columbidae*	*Macropygia emiliana*	Uncal buau
23		*Macropygia unchall*	Uncal loreng
24		*Streptopelia chinensis*	Tekukur Biasa
25	*Corvidae*	*Cissa thalassin*	Ekek geling
26	*Dicaeidae*	*Dicaeum sanguinolentum*	Cabai gunung
27		*Dicaeum trigonostigma*	Cabai bunga api
28		*Dicaeum trochileum*	Cabai jawa
29	*Dicruridae*	*Dicrurus leucophaeus*	Srigunting kelabu
30		*Dicrurus macrocerus*	Srigunting hitam
31	*Estrildidae*	*Lonchura leucogastroides*	Bondol jawa
32		*Lonchura punctulata*	Bondol peking
33	*Hirundinidae*	*Hirundo tahitica*	Layang-layang batu
34		*Hirundo rustica*	Layang-layang api
35	*Muscicapidae*	*Brachypteryx leucophrys*	Cingcoang coklat
36		*Culicicapa ceylonensis*	Sikatan kepala-abu
37		*Eumyias indigo*	Sikatan ninon
38		*Fidecula mugimaki*	Sikata mugimaki
39		*Ficedula westermanni*	Sikatan belang
40		*Ficedula zanthopygia*	Sikatan emas
41		*Muscicapa ferruginea*	Sikatan besi
42		*Myiomela diana*	Berkecet biru-tua
43		*Rhipidura phoenicura*	Kipasan ekor-merah
44	*Motacillidae*	*Motacilla cinerea*	Kicuit batu
45	*Oriolidae*	*Coracina javensis*	Kepudang sungu gunung
46		*Oriolus chinensis*	Kepudang kuduk hitam
47	*Phasianidae*	*Gallus gallus*	Ayam hutan merah



48	*Picidae*	*Dendrocopos moluccensis*	Caladi tilik
49	*Pycnonotidae*	*Pycnonotus aurigaster*	Cucak Kutilang
50		*Pycnonotus bimaculatus*	Cucak gunung
51	*Rallidae*	*Amaurornis phoenicurus*	Kareo padi
52	*Rhipiduridae*	*Rhipidura euryura*	Kipasan bukit
53		*Rhipidura phoenicura*	Kipasan Ekor-merah
54	*Scolopacidae*	*Actitis hypoleucos*	Trinil pantai
55	*Sittidae*	*Sitta azurea*	Munguk loreng
56	*Sturnidae*	*Acridotheres javanicus*	Kerak kerbau
57	*Sylviidae*	*Megalurus palustris*	Cicakoreng jawa
58		*Orthotomus sepium*	Cinenen jawa
59		*Orthotomus sutorius*	Cinenen Pisang
60	*Timaliidae*	*Pnoepyga pusilla*	Berencet kerdil
61		*Pteruthius aenobarbus*	Ciu kunyit
62		*Pteruthius flaviscapis*	Ciu besar
63		*Stachyris melanothorax*	Tepus pipi-perak
64		*Stachyris sp*	Tepus sp
65		*Alcippe pyrrhoptera*	Wergan jawa
66	*Turdidae*	*Enicurus leschenault*	Meninting besar
67		*Enicurus velatus*	Meninting kecil
68	*Zosteropidae*	*Lophozosterops javanicus*	Opior jawa
69		*Zosterops montanus*	Kacamata gunung
70		*Zosterops palpebrosus*	Kacamata biasa

THE EFFECT OF DIFFERENT DENSITY OF ARTEMIA NAUPLII ON THE GROWTH OF BALASHARK SEED (*Balantiocheilus melanopterus* Bleeker)

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Abstract

This experiment aimed to determine the effect of quantity of live food, artemia nauplii for ornamental fish, balashark seed at research intitute for ornamental fish, Depok. The experiment was conducted at wet laboratory using aquarium 40x30x30 in size and water volume 30 L. One hundred fifty larvae with the weight of 1.29±0.05 mg were reared in aquarium during fourty five days. Treatment applied were various quantity of nauplii artemia i.e; 50,100,200 artemia nauplii/larvae/day. The experiment was conducted in a completely randomized design with three replicates for each treatment. Parameter evaluation on respond of treatments were growth rate of body weight and length, weight and lenght gain, and survival rate. The result of the experiment showed that specific of growth rate (body weight and lenght), weight and lenght gain were highly significantly different (P<0.01) among the treatments. Responds of the both parameters will be increasing if nauplii artemia given to be increasing. Body weight gain at each treatment were 28.60 mg, 44.84, and 81.49 mg whereas body length gain were 10.17;11.07 and mm at the end of experiment. For efficiency and economical aspect, it is recommended that artemia nauplii given to the larva until 7 days old was 50 artemia nauplii/larvae/day, then increased to be 100 artemia nauplii/larvae/day untill 18 days old, and 200 artemia nauplii/larvae/day untill 45 daysold.

Keywords: artemia nauplii, balashark exotic fish, Specific growth rate

I. INTRODUCTION

Balashark (*Balantiocheilus melanopterus* Bleeker) is a type of freshwater ornamental fish that is favored by many export and domestic markets. The beginning of its existence in the market came from catches in nature, from the public waters of the provinces of South Sumatra, Jambi, West and Central Kalimantan. The population of balashark in their habitat has greatly decreased due to over-exploitation and is feared to go extinct if it is not controlled. At present balashark fish can already be bred in a controlled system with environmental control and quality feeding. The successful breeding of these fish will provide hope in ensuring the sustainability of production. The critical phase in seed maintenance is at the time of the transition of feed from endogenous (inborn) to exogeneous (feed from outside). These fish seeds only rely on a limited amount of innate energy for organ development and life.

Balashark larvae begin to forage from the environment on the fifth day. If in this phase there is not enough food available, the larvae will run out of energy and die. The accuracy of the supply of feed both in terms of quality and quantity will determine the success of production. The type of feed in the initial stage must be sized according to the mouth opening, easily provided, digestible and nutritious. At the beginning of foraging from the outside environment, the mouth width of the balashark larvae was 0.5 mm and the mouth opening was 0.27 mm (Baras et al., 2007). With such a mouth opening, rotifers are a type of feed that is considered suitable for initial stadia seeds, but to obtain them requires more energy and maintenance tanks. Balashark larvae that got feed from outside at the beginning was also been able to prey on artemia nauplii. Provision of artemia nauplii is easier, does not require a lot of places, but the use of artemia will require greater costs because the price is expensive. Therefore, in its application, the use of artemia nauplii must be efficient through controlling the appropriate amount of administration. The quality of natural food is assessed from protein content, completeness and percent content of essential amino acids, digestibility, protein efficiency ratio (PER), and minerals. Artemia nauphlii has complete essential amino acids, but deficiency of histidine, aspartic acid, glutamic acid, proline and serine (Claus et al., 1979 in Watanabe et al., 1983). The last these two amino acids are needed in the manufacture of young bone tissue for seed growth. Growth and conversion efficiency of natural feed can be optimized by manipulation of amino acid composition adjusted to the needs of amino acid larvae (Conceicao et al., 2003). The mineral content of phosphorus and calcium, is also high enough to support the growth of young bones that is 1.51 mg/g and 0.21 mg/g (Watanabe et al., 1983). Further trials on goldfish showed that the protein digestibility of the artemia nauplii was higher than that of Brachionus sp, while the PER value was the same as that of Brachionus sp, Tigriopus, Moina and Daphnia. Deficiency of some amino acids from artemia nauplii requires us to provide seed feed in adequate doses. The quantity of natural feed consumed is also determined by the digestibility speed of the species that utilize it (Aslianti and Afifah, 2012).

Interested in the above problems as well as efforts to provide efficient feed for balashark fish seeds, an experiment was conducted to study the effect of nauplii artemia density on the growth of balashark aged 5 to 50 days. From this experiment, it is hoped that data on the number of viable and economical artemia nauphlii is available to support seedgrowth.

II. RESEARCH METHODS

The test fish used in this experiment was obtained from the balashark hatchery at the Indonesian Ornamental Fish Research and Development Center, Depok. The experiments were carried out when larvae`s ages was 5 until 50 days. The mean initial

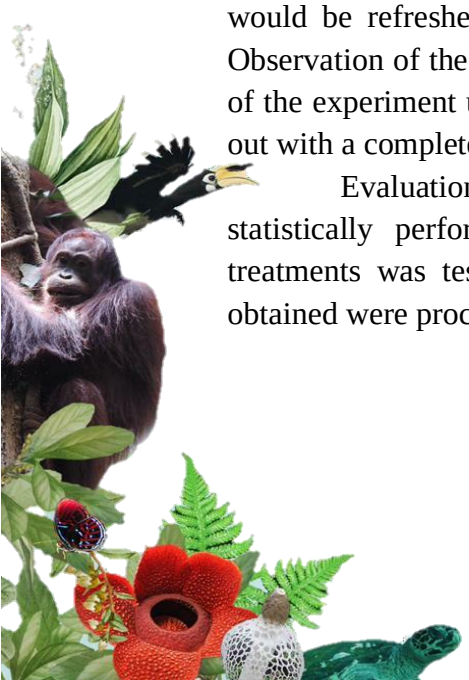
individual weight was 1.29 ± 0.01 mg and with a total length of 5.93 ± 0.12 mm, 150 seeds were stocked in a 40x30x30 cm aquarium with 30 L water volume. As the treatments, the number of artemia nauplii given were (a) 50; (b) 100; (c) 200 nauphlii/larvae/day. To determine the number of artemia nauplii, a preliminary experiment was conducted by observing the consumption of artemia nauplii by 50-day-old balashark seeds. Prelimenary observations were carried out on 125 ml of plastic cups (6.5 cm in height and 5.0 cm in diameter). Artemia nauphlii was obtained by incubating an artemia egg (cyst) in a salt water medium for 24 hours. Then the resulting artemia nauplii was separated from the unhatched cyst and was counted the number of nauphlii/ml by sampling. The amount of artemia nauplii given was adjusted to each treatment. The feeding frequency was six times per day with the same amount for each feeding time, so that the number of artemia nauplii given was 1250, 2500, and 5,000 nauphlii per aquarium. Feeding schedule was started at 6:00, until 21:00, with a time interval of 3 hours. The parameters used to evaluate the effect of the treatment were the specific growth rate (body weight and length) using theformula:

$$SGR = \frac{Ln\ Wt/Lt - Ln\ Wo/Lo}{t} \times 100\%,$$

t = maintenance period (days)
Wo = average individual weight at the beginning of maintenance (mg)
Wt = Average individual weight at the end of maintenance (mg)
Lo = average total body length at the beginning of maintenance (mm)
Lt = Average total body length at the end of maintenance (mm)
SGR = Specific Growth Rate (%/day)

Weight gain, seed length, and survival rate were evaluated as well. Observation was carried out to find out the growth pattern of the weight of the test fish every with 9 days interval. Weight measurement was done by sampling as much as 20% of the fish population tested. The seeds were made unconscious with anesthesia and weighed collectively in a cup filled with water, using sartorius analytical scales with an accuracy of 0.01 mg. The number of seed was 10 seeds/weighing. Anesthesia using 0.3 ml of phenoxy ethanol/1 liter of water. The fish would pass out for a moment, then the fish would be refreshed in a filled-water container, before returning it to the aquarium. Observation of the total length of the fish was carried out only at the beginning and end of the experiment using millimeter blocks and microscope. The experiment was carried out with a completely randomized design with three replications.

Evaluation of the effect of the treatment towards the parameters tested was statistically performed using ANOVA and the average response value between treatments was tested with the smallest significant difference test (LSD). The data obtained were processed using the SPSS program, version 17.0.



III. RESULTS AND DISCUSSION

A. Growth Weight

The growth of balashark seed for the three treatments showed a different pattern until the end of the study due to differences in growth velocity. The seed growth up to day 18 was still close to the same among the three treatments (Figure 1). However, the growth of larvae with density of 200 nauphlii/larvae/day increased higher and a more noticeable increase began after 27 days. In the treatment of 100 nauplii/larvae/day, the addition of seed weight showed higher than the 50 nauplii/ larvae/day since day 27 and the difference was increasingly visible until the end of the study period. The weight growth in these two treatments was lower compared to the treatment of feeding 200 nauplii/larvae/day.

In the initial phase, balashark larvae has transparent body and grow slowly, then grow rapidly after the organs are fully developed. Ontogeny study by Baras *et al*., (2007) of balashark showed that the final transition from larval stage to juvenile stage occurred on day 27 after hatching with a total length of 17 mm, characterized by an adult form of pigmentation pattern on anal, dorsal, pelvic and caudal fins. This means that the development and refinement of balashark larvae lasts until the 27th day. Ontogeny studies do not observe the development of digestive organs, but the stomach on the 18th day observations is still smaller than on the 27th day. This indicates that there is still development of stomach between the 18th and 27th days. Therefore, the larval growth of balashark until the 18th day for all treatments is still slow, this is due to the fact that nauplii artemia consumed is mainly used for organ improvement rather than to grow according to the results of a study by Baras et al.,(2007).

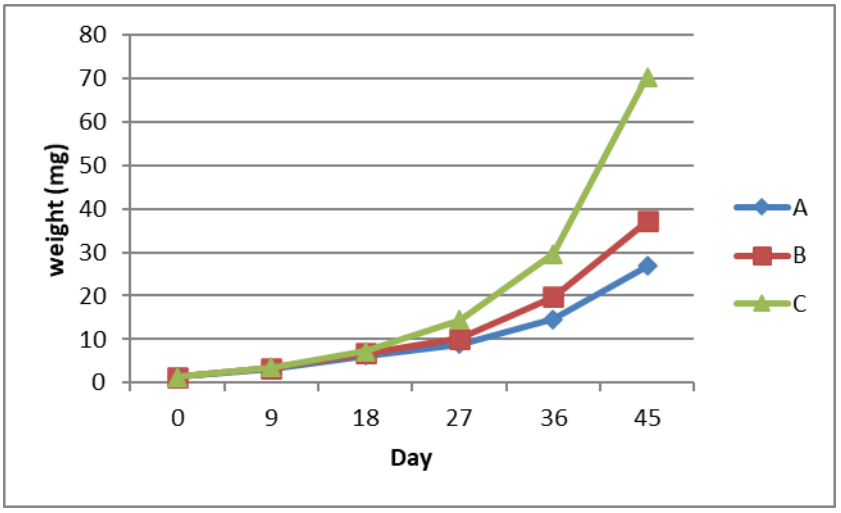


Figure 1. Growth performance of *balashark* seed fed different number *of* Artemia nauplii during experiment

Khojasten (2012) states that the digestive organs of fish larvae of the teleostei group in the juvenile stage are more fully developed by being characterized by the formation of esophagus, stomach, pyloric caeca and gastric glands. The differentiation of the formation of pyloric caeca is the last indication of the development of digestive organs in seeds (Hamlin et al., 2006). Hubenova et al., (2010) suggested that the presence of gastric glands and alimentary channels is very important in digestion and absorption. The more perfect digestibility system on balashark seeds, on the 27th day observation allows the seeds to digest artemia nauplii and absorpt better, so that the growth rate much increased after day 27. Furthermore, the weight growth of balashark seed rapidly increased on the following day. In the growing phase, after the 27th day, energy needed will be higher, meaning the larvae need morefeed.

Therefore, the lower the number of nauplii given per larvae, the lower the growth weight. From the graph of growing up to day 27 (Figure 1), it can be interpreted that 100 artemia nauplii/larvae/day given can still offset the growth of seeds fed with 200 artemia nauplii/larvae. However, after that period the amount of artemia nauplii given must be at least 200 nauplii/larvae/day to maintain good growth. From Figure 1, it can be interpreted that the number of artemia nauplii 50 nauplii/larvae/day for balashark up to the age of 23 days or 18 days maintenance period is sufficient to guarantee the development and health of the fish. Furthermore, the density of artemia nauplii increased to 100 nauplii/larvae/day at the age of 30 or 27 days trial period and then the density of artemia nauplii given increased to 200 nauplii/larvae/day to seed on 50 days or 45 days maintenanceperiod.

Table 1. Performance of body weight of balashark fry fed different number of *Artemia nauplii*

Parameter	(Number of *artemia nauplii*/larvae/day		
	50 *nauplii artemia*/larvae	**100 *nauplii artemia*/larvae**	**200 *nauplii artemia*/larvae**
Initial body weight (mg)	1,29±0,00	1,28±0,01	1,29±0,02
Final body weight (mg)	29,90±3,69	46,13±2,72	82,78±1,04
Body weight gain (mg)	28,60±3,69 [a)]	44,84±2,71 [b)]	81,49±0,73 [c)]
Spesific growth rate (body weight) (%)/day	7.84± 0,29 [a)]	8.91±0,06 [a)]	10.38±0,05 [b)]

Note : Different superscript letters in the same row are statistically (P<0,05)

Excessive feeding will affect the speed of evacuation of feed from the digestive system in the larvae of Doncella, Pseudoplatystoma puntifer and botia (*Chrommobotia macracantus*) (Baras et al., 2011; 2012), and in larvae of the Metapenaeus ensis (Chu et al., 1986). Such conditions can reduce the efficiency of digestion and absorption of nutrients. Generally the interval of feeding artemia nauplii for ornamental fish larvae is 2-3 hours (Lim et al., 2003), according to the time used in this experiment. Thus the provision of 100 to 200 nauplii artemia/larvae/day in the initial period until the age of

the 23-day balashark larvae or the trial period on day 18 can be considered less efficient in terms of digestive and economic efficiency aspects.

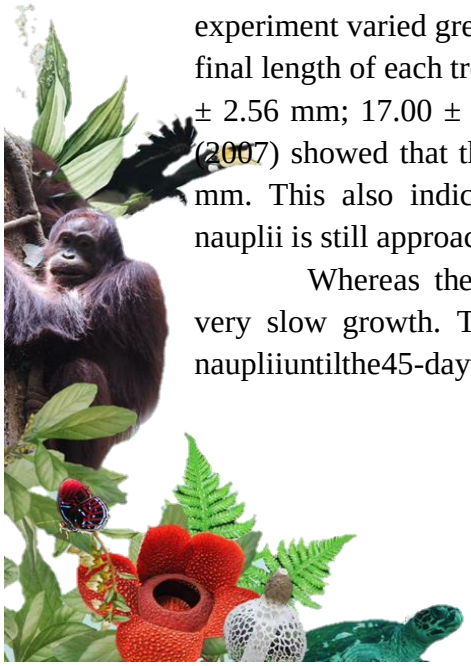
Results of statistical analysis showed that both the specific growth rate and weight gain were significantly different between treatments (P> 0.05). Specific growth rate of balashark seed in the treatment of giving 200 artemia nauplii/larvae/ day was significantly higher (P <0.01) compared to the other two treatments (Table 1). While the weight growth of balashark seed in the treatment of giving 100 artemia nauplii/larvae/day was also significantly higher (P <0.05) compared to 50 artemia nauplii/larvae/day. However, the length growth and the specific growth rate between the two treatments did not show any significant differences (P> 0.05) (Table 2). The final weight in the three treatments giving 50, 100, and 200 artemia nauplii/larvae/ day was 29.90 ± 3.69; 46.13 ± 2.72; 82.78 ± 1.04 mg. There is no comparable data yet for optimal growth of balashark at the age of 45-50 days. However, the study of Permana et al., (2012) on the need for artemia nauplii of larval and juvenile phases noted that the weight of botia (Cyprinidae class) reached 30 mg at 45 days. This means that the weight growth of balashark seed is much higher than that of botia.

From the results of this study, it can be concluded that the number of artemia nauplii given in balashark seed needs to be set in stages according to the age of the fish in order to maintain optimal and economical efficient growth. By giving periodically increased naupli artemia as stated above, the number of artemia nauplii consumed by one balashark seed until reaching 50 days or 45 days trial period is 5400 artemia nauplii. Referring to the opinion of Leger et al., (1987) that the dry weight of an artemia nauplii is 3.33 ug, the production cost for one balashark seed until the age of 45 is Rp.11.57,-

B. Length growth

The ontologeni study conducted by Baras et al., (2007) suggested that the growth of balahark larvae was very slow when they began to eat artemia nauplii from the external environment (*exogeneous*), which was 0.3 mm/day. Then after day 9 increased to 0.7 mm/day, and decreased again at the age of 17 days after hatching. The average specific length growth rate and total length of balashark larvae in this experiment varied greatly due to differences in the number of artemia nauplii given. The final length of each treatment giving 50, 100 and 200 artemia nauplii/larvae/day is15.56 ± 2.56 mm; 17.00 ± 0.93; and 20.80 ± 0.64 mm. The ontogeny study by Baras et al., (2007) showed that the total length of balashark larvae on the 26th day reached 17.20 mm. This also indicates that the administration of 200 artemia nauplii/ larvae/day nauplii is still approaching with propergrowth.

Whereas the treatment of 50 and 100 of artemia nauplii/larvae/day showed very slow growth. This characterizes that the same dosage level of giving artemia naupliiuntilthe45-daytrialperiodisindeedinsufficienttosupportadecentlength



growth. This is also supported by a wide variation of the total length of seed in the two treatments at the end of the study (Table 2), which shows the competition to get feed.

Table 2. Performance of total lenght of balashark fry fed different number of *Artemia nauplii*

Parameter	Number of *artemia nauplii*/larva/day		
	50 *nauplii artemia*/larvae	**100 *nauplii artemia*/larvae**	**200 *nauplii artemia*/larvae**
Initial lenght (mm)	5,93±0,05	5,93±0,05	5,93±0,05
Final lenght (mm)	15,56±2,56	17,00±0,93	20,80±0,64
Total Lenght gain (mm)	9,63±2,38 [a)]	11,07±1,43 [a)]	14,87±1,63 [b)]
Spesific growth rate (Length) (%)/day	2,48± 0,38 [a)]	2,62±0,16 [a)]	3,13±0,08 [b)]
Survival rate (%)	93,65±0.31	98,66±0.00	98,83±0.37

Note : Different superscript letters in the same row are statistically (P<0,05)

The results of statistical analysis showed that the increase in total body length and growth rate of specific length of seed treatment giving artemia nauplii with the number of 50 and 100 artemia nauplii/larvae/day did not show any significant difference (P> 0.05), but the increase in length of the two treatment groups was markedly slower (P <0.05) compared to the treatment of artemia nauplii administering 200 artemia nauplii/larvae/day. Both the length gain and the specific length growth rate also showed an increase in line with the increasing number of artemia nauplii given. The increase in seed length with the treatment of giving 50 and 100 artemia nauplii/larvae/day was9.63 ± 2.38 and 11.07 ± 1.43 mm, while the seed length in the treatment of giving 200 artemia nauplii/day/larvae reached 14.87 ± 1.63 mm (Table 2).

The length increase is very closely related to bone growth. Minerals that play an important role in bone growth are calcium and phosphorus. According to Guillaume et al., (2001) calcium is very important for bone development and growth. According to Millalena et al. (2002), most of the calcium source for fish is absorbed from water, even according to Guillaume et al. (2001), 50-60% of calcium requirements for freshwater fish can be met from water. While the phosphorus content is generally from feed ingredients. In contrast to calcium, according to Millamena et al. (2002), phosphorus in feed becomes very important because the concentration of phosphorus in fresh water is very low. The availability of phosphorus from artemia nauplii as food, accompanied by optimal absorption of calcium from water is thought to be the cause of the difference in absolute length growth of balashark larvae. According to Watanabe et al., (1983) the mineral content of artemia nauplii varies greatly depending on the source of artemia obtained.Thephosphorouscontentofartemianaupliiis1.53mg/g(high)andcalcium 0.21 mg/g compared to other natural foods *Brachionus plicatilis, Daphnia sp., Moina sp. and Tigriopus japanicus,* a type ofcopepod.

In addition to calcium and phosphorus factors, the growth of young bones is also largely determined by the presence of proline and lysin (amino acids). Both of

these amino acids play a role as an adhesive in the formation of collagen (Reed, 1980). Collagen is a type of protein that is one of the main components of cartilage connective tissue, bone matrix, dentin, blood vessel layers (Horning et al., 1984). Collagen is synthesized in soluble shaped cells called tropokolagen, then removed from cells. After leaving the cell, the structure will change, forming insoluble fibrils to form collagen. Collagen consists of three polypeptide chains called triple helix, because these three chains will coexist, and the "sequences" of amino acids that make up this structure contain glycine almost every third position, so glycine is also needed for bone growth. Live food including artemia nauplii contains high enough glycine to reach 3.4 g/100 g protein and proline and lysine content of artemia nauplii also reach 4.7 and 6.1 g/100 g protein respectively (Watanabe et al., 1983). By the increasing the number of artemia nauplii given to balashark larvae, elements that support bone growth such as phosphorus, glycine, proline and lysine also increase. Therefore, the higher the number of artemia nauplii given to balashark larvae, the higher total length growth willbe.

Based on feeding behaviour, generally the seeds in the larval stage are more omnivorous or carnivorous that prey on zooplankton. This is related to the needs and availability of energy, because of limited innate energy (endogeneous). In zooplankton, amino acids come in two forms: free and bound to form proteins. Free amino acids from zooplankton are the main supply of energy in the initial stage when the innate energy runs out (Finn et al., 2002; Watanabe and Kiron, 1994). The energy source of free amino acids plays a very important role at depositing protein tissue during the process of growing larvae (Parra, et al., 1999). Zooplankton generally contain free amino acids ranging from 10 to 20% of the total amino acids, depending on the type of zooplankton (Fyhn et al, 1995: van der Mecren et al., 2001). Free amino acids from nauplii artemia in this study were not analyzed, but very dependent on the type and population and estimated to only reach 4-6% of the total amino acids (Helland et al., 2000: van der Mecren et al., 2001). Therefore, in the early period of larval development always use zooplankton as a feed provider of free energy. Aside from being a source of free amino acids providing energy, natural food also helps provide other peptide compounds that play a role in perfecting digestive organs (Ronnestad et al., 2003). Study on lysis of post mortem on natural feed *Brachionus sp.* under simulation conditions of the digestive system has shown that small peptides (Molecular Weight <1500 Da) are the end result of lysis, and these peptides exert a positive influence by stimulating expression of the brush border enzyme and intestinal improvement (Cahu et al., 2001). Kolkovsky's (2001) study of carp showed that the existance of live food, zooplankton not only donates digestive enzymes, but also activates zymogens in the intestinal larvae to stimulate endogeneous trypsin. From the description above, it is known that the source of free amino acids from natural food is the main energy source when the initial stages of larvae begin to prey on natural food, and the availability of free amino acids from natural food is very supportive of larval metabolic processes for organ developmentand

growth. Ronnestad et al., (1999) concluded that the pool of amino acids in the yolk decreased during development and has been used mostly as a metabolic energy substrate, partly utilized at different speeds for body protein synthesis. Amino acids from proteins in natural food are a source of protein synthesis to be accumulated in tissues expressing growth in weight and length. Studies from the early stages of feeding turbot larvae (marine fish), predation of zooplankton rotifers showed that the efficiency of amino acid transfer to larval tissue forms and biomass was only around 10 to 25% (Oei et al.,1997).

Only a small fraction of amino acids and energy from rotifers have been converted into larval proteins or biomass. Several other researchers suggested that high amino acid conversion efficiency occurs in larvae if the digestion speed is low and the duration of the retained feed in the intestine is high (Werner and Blaxter, 1980). Rust (1995) reported that fish larvae without the stomach, in the initial period assimilating simple forms of amino acids were more efficient than complex nutrient forms (peptides, proteins). In Senegal sole, *Solea senegalensis*, FAA (free amino acid) is transferred 3.5 times faster than protein from gut into body tissue (Ronnestad et al., 2003).

Artemia nauplii has low source of free amino acids from the total amino acids, so if the amount given to the larvae is limited it will affect metabolism and growth rate. Therefore, in this experiment the less amount of artemia was given, the lower growth both the length and the weight. To ensure consistent larval growth in optimal feed dosage levels, artemia nauplii must be calculated according to the stages of growth.

If the amino acids from the innate egg yolk of the larvae have been consumed by the digestive system it becomes critical in ensuring the stability of the supply of amino acid metabolic pathways for larval tissue growth (Ronnestad et al., 2003). They further stated that if the egg yolk is depleted, while the development of larvae digestive organs is not perfect and free amino acids from feed are not available, the larvae will autolysis to utilize their body's energy and then the larvae will die. In this experiment, the passage of balashark seeds was very high reaching the range of 93.65% to 98.83%. Indicating that the energy supply from artemia nauplii is in the lowest level of 50 artemia nauplii/larvae/day is still feasible to supportlife.

IV. CONCLUSION

The conclusion of this research is : The quantity of artemia nauplii as a natural food for balashark larvae greatly influences the growth of body weight and total length. The highest growth rate and length were achieved in the treatment of giving artemia nauplii by 200 nauphlii/larvae/day. To achieve optimal utilization of artemia nauplii as a natural food for balashark larvae, it is recommended that the feeding quantity is increased gradually. The number of nauplii artemia is increased 50-100

nauphlii/larvae/day up to 18 days, then increased on day 28 with the number of 200 nauphlii/larvae/day.

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ANTIBACTERIAL TRAIT OF GREEN TEA (*Camellia sinensis* L) LEAF EXTRACT AGAINST ESBL-PRODUCING BACTERIA *Escherichia coli* AND *Klebsiellapneumoniae*

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Abstract

Bacterial resistance to antibiotics is one problems in health. *Escherichia coli* and *Klebsiella pneumoniae* belong to group of bacteria that resistant to β-lactam antibiotics such as penicillin and cephalosporin, because these bacteria have a beta lactamase enzyme that can break the amide ring on the beta lactam ring, so the antibiotic becomes inactive. The use of antimicrobial materials from nature such as plants, can be an alternative to handle infections. Green Tea (*Camelia sinensis* L) is a herbal plant that contains active chemical compounds that act as antibacterial. Green tea leaves contain catechins, tannins and flavanols which can inhibit and kill bacteria. This study aims to determine the antibacterial trait of green tea leaf extract by the dilution method, on the growth of *E. coli* and *K. pneumoniae* positive Extended Spectrum Beta Lactamase (ESBL) bacteria. This study used a randomized block design (RBD) with 6 levels of treatment and 3 repetitions. The treatment consisted of green tea leaf extract at concentrations of 1%, 2%, 4%, 8%, 16% and 32%, with positive control of tetracycline antibiotics. The results showed that green tea leaf extract at concentration of 1% had inhibitory effects on the growth of ESBL-positive *E. coli* and *K.pneumoniae*, and at concentration of 2% it was able to kill *E. coli* and *K.pneumoniae* positive ESBL bacteria.

Key words: Antibacterial, ESBL, Extract, Green Tea

I. INTRODUCTION

Infection is disease and major health problem in various countries including Indonesia. Transmission of infection can occur from one person to another or from animals to humans, caused by bacteria, fungi, viruses and parasites.

Urinary tract infections (UTI) is one of infectious diseases that need attention. UTI is bacterial infections that occur in urinary tract, bladder or kidney. In normal conditions urinary tract does not contain bacteria, viruses or other microorganisms (Purnomo, 2011). However, due to each person's hygienic behavior, bacteria in urinary tract can be found. UTI mainly caused by Gram-negative bacteria such as *Escherichia coli*, *Proteus, Klebsiellapneumoniae* and *Pseudomonas*, (Seta S et al., 2015), which can come from water or contamination from anus.

Nowadays the resistance of bacteria that cause UTI to antimicrobials is increasing. Resistance is caused by bacteria that losing specific targets for the drug and

the presence of genetic changes (Jawetz et al., 2005). Resistance of K. pneumoniae and E. coli widely reported because of Extended Spectrum Beta Lactamase (ESBL) enzyme which belongs to these bacteria (Pradani and Kuswandi, 2016).

K. pneumoniae and *E. coli* produce betalactamase enzyme that can hydrolyze betalactam ring contained in betalactam class of antibiotics and cause resistance to these antibiotics (Tarina and Kusuma, 2017). Beta lactamase enzyme breaks the amide ring on beta lactam ring, causing antibiotics to become inactive (Soleha,2014).

Penicillin, cephalosporin, monobactam and carbapenem are betalactam class of antibiotics, because they have betalactam ring on their structure (Soleha, 2014). Beta lactam antibiotics are most often drugs that used to treat bacterial infections, but the level of bacterial resistance to beta lactam antibiotics continues to increase (Triana, 2014).

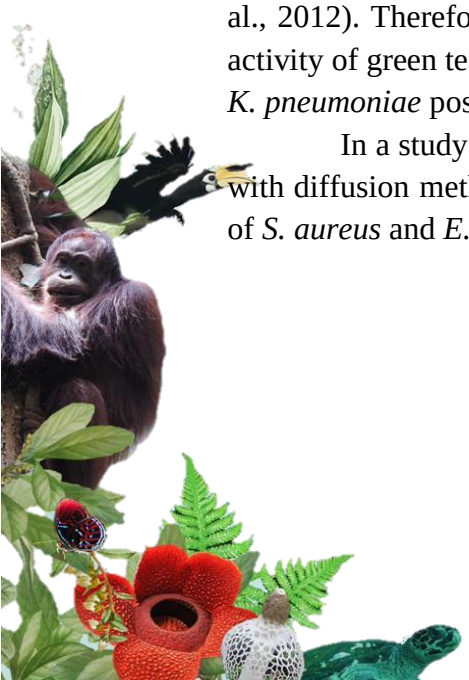
Based on data of bacterial patterns and resistance from urine isolates in 3 different places in Indonesia, namely Jakarta (Microbiology & Clinical Pathology Section FKUI-RSCM), Bandung (Clinical Pathology Section Hasanbiikin Hospital Microbiology Subdivision) and Surabaya (Soetomo Hospital Microbiology Section), on2002-2004period found that *E. coli* infection is 34.85%, *Klebsiella sp* (16.63%) and *Pseudomonas sp* (14.95%) (Huda, 2017).

Nowadays the use of antimicrobial materials originating from nature such as plants can be an alternative to handle infections caused by microorganisms. Plants contain compounds that can be potential as antimicrobials with various activity mechanisms (Rahmawati, 2015).

Tea drink widely known in Indonesia and in the world. Substances that contained in tea have many health benefits (Amelia et al., 2012). Green tea has pharmacological effects, such as : to reduce cholesterol, triglycerides, prevent dental caries, antimutagenic, antioxidant, antibacterial (Dewi, 2010).

Green tea contains polyphenols which are classified as catechins. Catechins consist of six compounds namely Catechin (C), Gallogatechin (GC), Epichatechin (EC), Epigallocatechin (EGC), Epicatechingallate (ECG), EpigallocatechinGallate (EGCG). EGCG is the most active compound. Catechins in tea serve as antimicrobial that have ability to damage cells from microorganisms, antioxidants, antiradiation, strengthen blood vessels, facilitate urine secretion, and inhibit the growth of cancer cells (Amelia et al., 2012). Therefore it is necessary to conduct research to determine the antimicrobial activity of green tea (*Camellia sinensis* L.) extract against clinical isolates of *E. coli* and *K. pneumoniae* positive ESBL.

In a study (Amelia et al., 2012) about the effectiveness of green tea leaf extract with diffusion method showed that green tea leaf extract was able to inhibit the growth of *S. aureus* and *E.coli* bacteria in extract concentration of 10%.



The purpose of this study was to determine the antibacterial trait of green tea leaf extract against ESBL positive *E. coli* and *K.pneumoniae* bacteria by the dilution method.

The hypotheses in this study are: 1) The presence of ESBL positive *E.coli* and *K.pneumoniae* bacteria sensitivity to green tea leaf extracts; 2) The effect of green tea leaf extract concentration on ESBL positive *E. coli* and *K.pneumoniae* bacteria; 3) There are differences in the minimum inhibitory concentrationfrom green tea leaf extract against ESBL positive *E. coli* and *K.pneumoniae*bacteria.

II. RESEARCH METHODS

A. Time Period and place ofresearch

The research was conducted at the Microbiology and Genetics Laboratory, Faculty of Biology, National University Laboratory Center, Jl. BambuKuning, Pejaten, Pasar Minggu, South Jakarta. The study was conducted in September 2017 - January 2018.

B. Materials of research

The tools used in this research are Laminar Air Flow, micropipette, analytical balance, autoclave, incubator, hot plate stirrer, Petri dish, vortex mixer, measuring flask, test flask, oven, measuring pipette, tube rack, spatula, inoculation loop, Bunsen burner.

Materials used in this study are: 1). Tea leaves obtained from Gunung Mas Puncak Tea Plantation, Bogor. Tea leaves have been processed as green tea and are ready-to-use packs which then extracted at the Indonesian Spice and Medicinal Research Institute, Bogor; 2) Bacteria test: culture of E. coli bacteria positive ESBL, culture of bacteria K. ESBL positive pneumoniae. Test bacteria were obtained from bacterial isolates of urine specimens of patients at the Microbiology Laboratory of Gatot Soebroto Hospital, which had been identified using Vitek 2 to determine the type of bacteria and its resistance test (ESBL); 3). medium Mueller Hinton Broth (MHB), Nutrient Agar (NA), Nutrient Broth (NB), Aquadest, NaCl 0.85%, McFarlandstandard.

C. Procedures

1. Tea Leaf Extraction

The dried tea leaves are ground to a powder weighing 250g. Green tea leaf powder was put in a maserator, 70% ethanol was added as a solvent in the ratio of 1:10 times simpliciaie 2500 ml then stirred until homogeneous. The mixture was left macerated for 48 hours in a closed maserator with daily stirring. Maserat filtered from

the pulp using filter paper. Then evaporated using a rotary evaporator at temperature of 70^{o} C and a pressure of 80 mBar to obtain a thick extract (100% concentration).Then the concentration of tea leaf extract as a treatment was made to be 32%, 16%, 8%, 4%, 2%, 1% in reaction slash using sterile MHB medium asdiluent.

2. Preparation of test bacteria

The test bacteria used, namely *E.coli* and *K. pneoumoniae*, were grown in Nutrient Broth (NB) for 24 hours. Standardizing the concentration of test bacteria using the McFarland 0.5 standard.

3. Antimicrobial treat testing by the dilution method

200µL of test bacteria were inoculated in each treatment tube, positive control and negative control. Furthermore, it was incubated at 37 oC for 24 hours. The positive control used tetracycline antibiotics, while the negative control only contained MHB medium. Bacterial counts are done by using the Total Plate Count TPC method using Nutrient Agar (NA) medium.

III. RESULTS AND DISCUSSION

The extraction result by using 2.5 kg simplicia obtained 539 grams of thick extract so that the yield is 21.56%. The results of antibacterial inhibitory test of green tea leaf extract against *E. coli* and *K. pneumoniae* positive ESBL showed the effect of the treatment on the growth of these bacteria (Table1).

Table 1.Effect of concentration of green tea leaf extract (*Camellia sinensis* L.) on ESBL positive *E. coli* and *K. pneumoniae* bacteria

Extract Concentration	*E.coli*(CFU/mL)			*K.pneumoniae* (CFU/mL)		
	n1	n2	n3	n1	n2	n3
1%	$5{,}3\cdot10^{3}$	$6{,}4\cdot10^{3}$	$5{,}6\cdot10^{3}$	61	70	69
2%	0	0	0	0	0	0
4%	0	0	0	0	0	0
8%	0	0	0	0	0	0
16%	0	0	0	0	0	0
32%	0	0	0	0	0	0
Positive Control (Tetracycline 10 µg)	$1{,}59\cdot10^{8}$	$7{,}65\cdot10^{7}$	$6{,}1\cdot10^{7}$	$2{,}30\cdot10^{8}$	$1{,}27\cdot10^{8}$	$2{,}45\cdot10^{8}$
Negative Control	$1{,}20\cdot10^{8}$	$1{,}32\cdot10^{8}$	$2{,}47.10^{8}$	$1{,}81\cdot10^{8}$	$1{,}69\cdot10^{8}$	$1,\ 82\cdot10^{8}$

Description: CFU: Colony Forming Unit, 0 (zero): no bacterial growth

Table 1 above shows that antibacterial inhibition of green tea leafextract against *E. coli* and *K. pneumoniae* positive ESBL is strongly influenced by the extract concentration. Concentration is an important factor in sensitivity test of antibacterial compounds (Rini et al., 2017). Higher concentration of antibacterial compound impact to the stronger antibacterialactivity.

According to (Purwanto, 2015) the type of antimicrobial material also determines the ability to inhibit bacterial growth. The difference in inhibition of each concentration is caused by the amount of antimicrobial active substances contained in the extract, the speed of antimicrobial material penetration into the medium, environmental pH, componentsmedia, inoculum size, incubation time and metabolic activity of microorganisms.Green tea contains chemicals that can be classified as phenol compounds (polyphenols, flavanols), non-phenol compounds (carbohydrates, pectin, alkaloids, proteins and amino acids, chlorophyll, organic acids, resins, vitamins and minerals), enzymes, and aromatic compounds . The active bacterial killer contained in green tea is the catechins found in polyphenols. Catechins are condensed tannins that are often called polyphenols because of the many hydroxyl functional groups they have (Astutiningsih et al.,2016).

Among polyphenols available in tea, catechins are the compounds most studied. A number of recent research states that catechins are the compounds that play the most role in health (Astutiningsih et al.,2016).

Based on Agustama's research (2012) Green tea leaf extract can inhibit the growth of antibiotic resistant bacteria, namely Methicillin Resistant Staphylococcus aureus (MRSA) and Multidrug Resistant Pseudomonas aeruginosa with a concentration of 400 ppm extract.

Green tea leaf extract has inhibitory effect on the growth of ESBL positive E. coli and K.pneumoniae bacteria due to the presence of an active chemical namely catechins. Catechinis polyphenol compounds which can inhibit bacteria by damaging the cytoplasmic membrane of bacteria composed of 60% protein and 40% lipids which are generally in the form of phospholipids. Catechin compounds damage the cytoplasmic membrane which causes the leakage of important metabolites that activate the bacterial enzyme system. Damage to the cytoplasmic membrane can prevent the entry of food ingredients or nutrients needed by bacteria to produce energy (Rustanti et al.,2013).

On destruction of the cytoplasmic membrane, the catechin compound releases H^+ ions which then attack the hydrophilic group (hydroxy and phosphate groups) on the surface of the cell membrane. Hydroxy groups on ergolesterol molecules that form hydrogen bonds are unable to maintain their bonds and position. Cell membrane is not able to withstand the pressure from the inside, consequently cytoplasm in the cell will penetrate out. in addition, the phospholipid H^+ molecule from the catechin compound will attack the polar group (phosphate group) so that the phospholipid molecule will

break down into glycerol, carboxylic acid, and phosphoric acid. This results in phospholipids being unable to maintain the shape of the cytoplasmic membrane as a result cytoplasmic membranes will leak so that substances for bacterial cell metabolism will be thrown out and bacteria will die (Rustanti et al., 2013).

Polyphenols can inhibit the attachment of bacterial cells. Polyphenols will interact with bacterial proteins, enzymes, and lipids that can change the permeability of bacterial cells so the metabolism of bacteria is disrupted. Passively, polyphenols enter the bacterial cytoplasmic membrane resulting increasing cell membrane permeability, and leakage of important substances contained in bacteria, such as proteins, nucleic acids, and ions (Zahro, 2015). Due to leakage in the cytoplasm, the cell will damaged or die.It can said that by concentration of 1% of green tea leaf extract, the activity of catechin compounds is enough to disrupt bacterial metabolism and inhibiting the growth of ESBL-positive *E. coli* and *K.pneumoniae*bacteria.

Minimum Inhibitory Concentration (MIC) is minimum concentration of a substance that has the effect to inhibit the growth of microorganisms (Rostinawati, 2009).Dilution method test results show that the Minimum Inhibitory Concentration (MIC) values are the same in ESBL-positive *E. coli* and *K.pneumoniae*. Green tea leaf extract with a concentration of 1% can inhibit the growth of *E. coli* and *K. pneumoniae* bacteria. so it can be concluded that the extract of green tea leaf has potential as an antibacterial in inhibiting the growth of ESBL *E.coli* bacteria and positive ESBL *K.pneumoniae* bacteria.

In this study, the number of ESBL positive *E. coli* bacteria that still survive at extract concentration of 1% more than ESBL positive *K. pneumoniae*, this is due to differences in the cell structure of the two types of bacteria. *K. pneumoniae* has 2 types of antigens on the cell surface, namely O antigens and K antigens, while *E. coli* has 3 types, O antigens, K antigens, and H antigens on the cell surface. *K. pneumoniae*also distinguished as non-motile bacteria since they do not have flagella that may make them more sensitive to the catechin compounds contained in green tea leaf extract.

Inhibition of green tea leaf extract with tetracycline antibiotics also showed a significant difference. The ability of green tea leaf extract to inhibit test bacteria was much better than tetracycline antibiotics. This can occur because the bacteria tested are resistant to the antibiotic. In the study (Refdanita et al., 2010) K. pneumoniae had the highest successive resistance to amoxicillin, penicillin G, ampicillin, chloramphenicol, cephalexin, tetracycline, kanamycin, and sulbenicillin. *E. coli* has the highest resistance respectively to ampicillin, penicillin G, amoxicillin, chloramphenicol, tetracycline and sulbenicillin. *E. coli* bacteria were also found to be resistant to tetracycline antibiotics in research conducted by (Noviana, 2004) and research (Jurnalis et al., 2015).

IV. CONCLUTIONS AND RECOMMENDATION

A. Conclusions

The study concluded that:

1. Green tea leaf extract has ability to inhibit bacterial growth *E. coli* and *K. pneumonia* positiveESBL.
2. Concentration of the extract affected the growth of *E. coli* and*K.pneumonia* positive ESBL bacteria.
3. Minimal inhibitory concentration of green tea leaf extract against *E. coli* and *K. pneumonia* positive ESBL bacteria in this study was1%.

B. Recommendations

It is necessary to test the antibacterial treat of green tea extract against other antibiotic multiresistant bacteria.

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ANTIBACTERIAL ABILITY OF GUAVA (*Psidium guajava* L) LEAF EXTRACT AGAINST ESBL-PRODUCING BACTERIA *Escherichia coli* AND *Klebsiella pneumoniae*

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Abstract

Antibiotics are often used to handle infection. However, long-term and uncontrolled use of antibiotics can cause resistance. One case of bacterial resistance is the ability of bacteria to produce Extended Spectrum Beta Lactamase (ESBL) enzyme as in *Escherichia coli* and *Klebsiella pneumoniae*. Guava (*Psidium guajava L.*) leaf widely used as traditional medicine. Chemical compounds in guava leaves can inhibit bacterial growth. This study aims to determine the antibacterial treat of guava leaf extract against bacteria producing ESBL *E. coli* and *K. pneumoniae* by dilution method. The results showed that guava leaf extract influenced the growth of bacteria ($p < 0.05$). The effectiveness of guava leaf extract against *E. coli* was at a concentration of 4% while against *K. pneumoniae* was at a concentration of 2%. It was concluded that guava leaf extract could be one antimicrobial alternatives in inhibiting the growth of positive bacteria ESBL *E. coli* and *K. pneumoniae.*

Keywords: Antibacterial, Guava Leaf, ESBL, Extract

I. INTRODUCTION

Infection is a common everyday problem. Infections are caused by bacteria or pathogenic microorganisms, microbes enter the body's tissues and multiply in the tissues (Soranta, 2009). One infection that often occurs is a urinary tract infection (UTI). UTI is mainly caused by the presence of bacteria in the urinary tract, including the bladder and kidney (Fish, 2009). The main cause of UTI is Gram negative bacilli which are the normal flora of the digestive tract, such as *E.coli*, *Kleibsiella*, *Proteus*, and *Enterobacter* (Fenty and Syafada,2016).

Antibiotics are often used to handle infection. However, long-term and uncontrolled use of antibiotics can cause resistance, and it will be serious problem in health. The emergence of bacteria resistant to several types of antibiotics causes the treatment of infections is no longer efficient. Cephalosporin class of antibiotics, especially the third generation (cefotaxime and ceftazidime) has been used extensively in the treatment of various infectious diseases, including UTI. Because cephalosporins have a stronger and broader activity than the previous generation against Gramnegative

bacteria. This antibiotic can be used parenterally in serious infections that resistant to amoxicillin and first generation cephalosporins (Jawetz, 2005). The cause of resistance to β-lactam drugs, especially the 3rd generation cephalosporins above, is due to the production of extended-spectrum β-lactamase enzymes, abbreviated as ESBL (Citizens and Apriliana, 2014).

Antimicrobial Resistance research results in Indonesia, Prevalence and Prevention (AMRIN Study) which is a collaborative research between Indonesia and Netherlands in Dr. Soetomo Surabaya and Dr. RSUP Kariadi Semarang in 2001 - 2005 showed that there were multi-resistant bacteria, such as MRSA (Methicillin Resistant *Staphylococcus aureus*) and ESBL-producing bacteria such as *E. coli, K. pneumoniae, Shigella sp* and other Gram negative bacteria. The prevalence of ESBL bacteria has increased worldwide by 58% *K. pneumoniae* and 52% *E. coli* ESBL and also 24% MRSA (Hayati, 2017).

Nowadays plantsareone alternative to handle bacterial infections. Plants are one of the most important resources in treatment and to maintain public health. According to estimationby World Health Organization (WHO), 80% of the world's population still relies on traditional medicine including the use of medicines derived from plants. Today about a quarter of the modern medicines that circulate in the world come from active ingredients that are isolated and developed from plants (Sartinah et al., 2010).

Guava (*Psidium guajava* L.) leaf extract according to Purwiyanto (2006) is proven to inhibit the growth of *Escherichia coli* and *Staphylococcus aureus* bacteria. Yuniarti (1991) in Winarmo (1998) also stated that the decoction of guava leaves at the lowest level of 2% can inhibit the growth of *Staphylococcus aureus* and on 10% levels can inhibit the growth of Escherichia coli. These results can be used as a base for the use of guava leaves as antimicrobial (Sine and Fallo,2016).

Based on the background above, a study was conducted on the antibacterial activity of guava (*Psidium guajava* L) leaf extract against ESBL-producing bacteria *E. coli* and *K. pneumoniae*.

The objectives of this study are: 1). to determine the effect of guava (*Psidium guajava* L) leaf extract concentration on ESBL-producing bacteria *E. coli* and *K. pneumoniae*; 2). To determine the value of the minimum inhibitory concentration of guava (*Psidium guajava* L) leaf extract against ESBL-producing bacteria *E. coli* and *K. pneumoniae*.

The hypotheses in this study are: 1). the sensitivity of ESBL-producing bacteria *E. coli* and *K. pneumoniae* to guava (*Psidium guajava* L) leaf extract; 2). The influence of guava (*Psidiumguajava* L) leaf extract on ESBL-producing bacteria *E. coli* and *K. pneumoniae*; 3). There are differences in minimum inhibitory concentration of guava (*Psidiumguajava* L) leaf extract against ESBL-producing bacteria *E. coli* and *K. pneumoniae*

II. RESEARCH METHODS

A. Period and place of research

This research was conducted at Microbiology and Genetics Laboratory of the National University Faculty of Biology, Jl. BambuKuning, Pejaten, PasarMinggu, South Jakarta. The study began in September 2017 to January 2018.

B. Materials research

The tools used in this research are Laminar Air Flow, micropipette, analytical balance, autoclave, incubator, hot plate stirrer, petri dish, vortex mixer, measuring flask, test tube, oven, measuring pipette, tube rack, spatula, inoculation loop,

The material used was guava leaves taken in Jati Padang village. Guava leaves are washed and dried at room temperature then mashed and extracted at Indonesian Spice and Medicinal Research Institute, Bogor. The test bacteria used wereESBL positive *E.coli and K. pneumoniae* bacteria obtained from the patient's urine specimen at the Microbiology Laboratory of GatotSoebroto Army Hospital which had been tested for resistance. Mueller Hinton Broth (MHB), Nutrient Agar (NA), Nutrient Broth (NB), Aquadest, NaCl 0.9%, McFarland standard0.5.

C. Procedures

1. Making guava leafextract

Extraction method used is maceration. Dried guava leaves are mashed to a powder weighing 1.25 kilograms. Guava leaf powder was put in a macerator, 70% ethanol was added as a solvent in the ratio of 1:10 times simplicia and then stirred until homogeneous. The mixture was left macerated for 48 hours in a closed macerator with daily stirring. The macerate was filtered from the pulp using filter paper. Then evaporated using rotary evaporator at temperature of 70^{o} C and the pressure of 80 mBar to obtain a thick extract (100% concentration). Then the concentration is made to 32%, 16%, 8%, 4%, 2%, 1% using a sterile MHB medium.

2. Preparation of test bacteria

Using inoculate loop, 1-3scratch of *E. coli* and *K.pneoumoniae* colonies were inoculated into 5 mL Nutrient Broth (NB) and incubated at 37^{o} C for 18-24 hours. Then standardized using the McFarland 0.5 standard.

3. Antimicrobial treat testing by dilutionmethod

a. 200 µL of test bacteria were inoculated into MHI medium containing guava extract according to treatment, also for positive and negative control, then incubated at 37° C for 24hours.

b. The number of bacteria was calculated by the Total Plate Count (TPC) method using Nutrient Agar (NA)medium

III. RESULTS AND DISCUSSION

The results of antibacterial activity test of guava leaf extract against ESBL-producing bacteria E. coli and K. pneumoniae showed the effect of treatment on the growth of both types of bacteria as shown in Table 1.

Table 1: Effect of Guava Leaf Extract Concentration on *Escherichia coli* and *Klebsiella pneumoniae* Bacteria

Extract Concentration in MHB Medium	*E.coli* (CFU/mL)			*K. Pneumoniae* (CFU/mL)		
	n1	n2	n3	n1	n2	n3
1%	$1{,}50\cdot10^{7}$	$1{,}08\cdot10^{6}$	$1{,}60\cdot10^{6}$	$4{,}05\cdot10^{7}$	$5{,}70\cdot10^{7}$	$1{,}50\cdot10^{7}$
2%	$2{,}10\cdot10^{7}$	$1{,}55\cdot10^{6}$	$1{,}97\cdot10^{6}$	$1{,}07\cdot10^{4}$	0	$6{,}25\cdot10^{3}$
4%	$9{,}90\cdot10^{5}$	$3{,}1\cdot10^{3}$	0	0	0	0
8%	$8{,}3\cdot10^{3}$	0	0	0	0	0
16%	$2{,}7\cdot10^{3}$	0	0	0	0	0
32%	0	0	0	0	0	0
Negative Control (Medium MHB)	$6{,}6\cdot10^{5}$	$8{,}70\cdot10^{7}$	$1{,}33\cdot10^{8}$	$1{,}08\cdot10^{8}$	$9{,}15\cdot10^{7}$	$6{,}45\cdot10^{7}$
Positive Control (Tetracycline10 µg)	$2{,}51\cdot10^{6}$	$1{,}02\cdot10^{8}$	$5{,}15\cdot10^{7}$	$1{,}24\cdot10^{8}$	$7{,}80\cdot10^{7}$	$4{,}90\cdot10^{7}$

In the treatment of guava leaf extract concentrations of 1% and 2%, bacterial growth was still seen, but at concentration of 4% it was decreased or inhibited the growth of test bacteria. ANOVA test results of extract concentration effect on the growth of *E. coli* bacteria showed significant results ($p < 0.05$). Based on the results of the average difference test (Tukey) regarding to the effect of differences in extract concentrationshowsthatthereisnodifferencebetweenextractsof1%and2%.

Likewise with extract concentrations of 4%, 8%, 16%, and 32% there was no difference in the effect of concentration. But there is an effect of effectiveness at concentrations of 2% and 4% ($p < 0.05$).

ANOVA test results on the growth of *K. pneumoniae* bacteria showed significant results ($p < 0.05$,). Based on the results of the average difference test (Tukey) regarding the effect of differences in extract concentration showed that there were significant differences in effect from each extract concentration including concentrations of 1%, 2% and 4% each giving a significantly different effect ($p < 0.05$). At concentrations of 4%, 8%, 16%, and 32% there were no significant differences. This means that the extract concentration of 2% has been able to inhibit the growth of *K. pneumoniae*bacteria.

Table 1 shows that the antibacterial activity of guava leaves against ESBL bacteria *E. coli* and *K. pneumonia* was strongly influenced by extract concentration. This was marked by a decrease in the number of bacterial colonies after being treated and incubated for 24 hours compared to negativecontrols.

In this study, the number of bacteria in the positive control was greater than the extract treatment, this is because the test bacteria used were ESBL bacteria that were resistant to antibiotics. In addition, the class of antibiotics used is tetracycline wich is bacteriostatic, that works by preventing or inhibiting the growth of microbes but cannot kill.

The ability of antimicrobial material to inhibit the growth of microorganisms depends on concentration of antimicrobial material. This means that amount of antimicrobial material in a bacterial environment largely determines the life of the bacterium itself (Ajizah, 2004). This can be seen in extract concentration of 32% the number of E. coli bacterium colony is zero while in K. pneumonia bacteria the number of colony is zero in extract 4%. In this study the sensitivity of E.BL and *K. pneumoniae* bacteria was due to the presence of chemical substances in guava leaf extracts which are antimicrobial.

Guava leaves contain quite a lot of phenol compounds including tannins and flavonoids. Tannin is the main component in guava leaves, because the amount of tannin content is higher than that of other compounds (Afizia, 2012). According to Rizqina (2014) tannin as an antimicrobial that caused by the presence of a pirogarol group and a galoil group which is a phenol group and can inhibit bacterial growth or kill it by reacting with bacterial protein cells resulting in protein denaturation. Denaturation of proteins in bacterial cells causes bacterial metabolic disorders resulting in cell wall damage that ultimately causes celllysis.

According to Karlina et al (2013) tannins have an antibacterial role by binding to proteins so that the formation of cell walls will be inhibited. Tannin inhibition mechanism is that the bacterial wall that has been lysed due to flavonoid compounds causing tannin compounds can easily enter the bacterial cell and coagulate the

protoplasm of bacterial cells. In the study of Afizia (2012) using guava leaf extract containing tannins can suppress the growth of Aeromonashydrophila bacteria at a concentration of 250 ppm.

Besides tannins, guava leaves have flavonoid compounds. These compounds can be poison to the protoplasm, damage and penetrate walls and precipitate bacterial cell proteins. Large molecular phenolic compounds are capable of activating essential enzymes in bacterial cells even at very low concentrations. Flavonoids cause bacterial cell damage, protein denaturation, enzyme inactivation and cause cell leakage (Sine and Fallo, 2016).

Minimum Inhibitory Concentration (MIC) is the minimum concentration of a substance that has the effect of inhibiting the growth of microorganisms, after incubation with 37oC for 18-24 hours (Wiyanto,2010).

According to Wiyanto (2010), antibacterial is categorized as bacteriostatic if at a certain concentration the bacteria do not experience death, but also do not grow. Antibacterial is categorized as bacteriocidal if at a certain concentration the bacteria dies. Antibacterial compounds work by interacting with bacterial cell walls, resulting in permeability in bacterial cells and also diffuses into cells, resulting in inhibited bacterial growth (bacteriostatic) and or death (bacteriocidal). In addition, antibacterial compounds can also penetrate membranes and interact with genetic material so that bacteria can mutate.

Dilution method test results show different Minimum Inhibitory Concentration (MIC) values in the ESBL bacteria *E. coli* and *K. pneumoniae*. In *E. coli* guava leaf extract concentration of 4% showed that it can inhibit bacterial growth. Whereas in *K. pneumoniae* guava leaf extract concentration of 2% can inhibit bacterial growth. So it can be concluded that guava leaf extract has more potential as an antibacterial in inhibiting the bacteria ESBL *K. pneumonia* than *E. coli* bacteria.

IV. CONCLUTIONS AND RECOMMENDATION

A. Conclusions

1. Guava leaf extract has the ability to inhibit the growth of positive bacteriaESBL *E. coli* and *K. pneumoniae*.
2. Extract concentrations affect the growth of positive bacteria ESBL *E. coli* and *K. pneumoniae*.
3. The higher the concentration of guava leaf extract the higher the inhibitory growth of ESBL *E. coli* and *K. pneumoniae* bacteria. In this study the best concentration in inhibiting *E. coli* was 32%, and in *K. pneumonia* the concentration was4%.

4. In this study, the minimum inhibitory concentration of guava leaf extractagainst *E. coli* was 4% while the minimum inhibitory concentration of guava leaf extract against *K. pneumonia* was 2%.

B. Recommendations

Further research needs to be done between a concentration of 4% to 32% of *Escherichia coli* and between a concentration of 2% and 4% of *Klebsiella pneumoniae* to find the efficiency of guava (*Psidium guajava* L.) leaf extract in inhibiting bacterial growth.

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FINANCIAL ANALYSIS OF LIQUID ORGANIC FERTILIZER DOSAGE AND TYPE APPLICATION AGAINST PRODUCTION OF TOMATO (*Lycopersicum esculentum* Mill)

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Abstract

Tomato (*Lycopersicon esculentum Mill*) is one type of fruit vegetable that has the prospect to be developed because it has a high economic value and unique taste. Industry players utilize tomatoes to be used as sauces, cosmetic ingredients, even as a medicine Because It contains proteins, carbohydrates, fats, minerals, and vitamins. Research purposes analyzing the financial effects of the interaction between dose and liquid organic fertilizer to the production of tomato plants and tomato farmers' income. The research hypothesis suspected that the use of organic liquid fertilizer to the production of tomato plants are financially profitable. This research was compiled in a randomized block design (RBD) in a factorial pattern. The first factor is the type of liquid organic fertilizer which is a liquid organic fertilizer from seaweed (P1) and liquid organic fertilizer from organic materials (P2) and the second factor is the dose of liquid organic fertilizer. The use of liquid organic fertilizer seaweed increasing the number of leaves, total interest, and total production of tomatoes. The weight of tomatoes Increased from 15 972 kg to 28 240 kg per hectare. So financially Also increase of farmers' income of Rp. 19,318,305, - to Rp.54,652,305, - an increase of 182.90%. So financially Also increase of farmers' income of Rp. 19,318,305, - to Rp. 54,652,305, - an increase of 182.90%. So financially Also increase of farmers' income of Rp. 19,318,305, - to Rp. 54,652,305, - an increase of182.90%.

Keywords: organic fertilizer, seaweed, tomatoes, farmers' income

I. INTRODUCTION

Tomato (*Lycopersicon esculentum Mill*) is one type of fruit vegetables, perfect for development because it has a high economic value, has a unique flavor that is a blend of sweet and sour taste, making the tomato as a fruit that attracted many people. Tomato fruit can be consumed in a fresh state and processed into juice and seasoning mix. Industry players utilize tomatoes to be used as sauces, cosmetic ingredients, even as a medicine because it contains protein, carbohydrates, fats, minerals, and vitamins are a fairly complete vitamin. Content in tomatoes believed to cure variousdiseases.

Today most farmers still depend on inorganic fertilizers because they contain some nutrients in high amounts, whereas if the inorganic fertilizer was using continuously will cause negative impacts on soil and environmental conditions. There is one way to maintain and improve the environmental balance of soil aggregates by using a liquid organic fertilizer.

Many types of liquid organic fertilizer that is sold in the market among which the liquid organic fertilizer derived from seaweed and liquid organic fertilizer from

organic ingredients. Benefits of liquid organic fertilizer which overcomes the shortcomings of organic matter in the soil, improve the physical, chemical, and biological soil while reducing the use of inorganic fertilizers, in addition to the use of the type of organic liquid fertilizer dosing of liquid organic fertilizer also should be considered, the application of fertilizers in large quantities can cause symptoms of wilting and death of the plant.

Liquid organic fertilizer is the solution of decomposition of organic materials derived from crop residues, animal, and human feces that contain more than one element of the nutrient element. Advantages of organic fertilizer can cope with rapid nutrient deficiency, not problematic in nutrient leaching, and also able to provide nutrients quickly. If compared with inorganic fertilizers, organic liquid fertilizer is generally not damaging the soil and plants even though it was using as often as possible. Furthermore, this fertilizer also has a binder so that a solution of fertilizers applied to the soil surface can be directly used by plants (Hadisuwito, 2012). The use of liquid organic fertilizer is one way to overcome the shortage of organic matter, being able to improve the physical, chemical, and biologicalsoil.

In the market, there is not only a liquid organic fertilizer which was deriving from the residual organic materials are sold, there is also a liquid organic fertilizer which was deriving from seaweed. There is one of seaweed that has rich in minerals and harvested because of its beneficial effect that is *Ascophyllum nodosum. A. nodosum* that belongs to the group of brown algae (Phaeophyceae), and is one of the main species of brown algae that is widely used. This seaweed contains relatively abundant nutrients such as : Macro minerals, Micro minerals, Amino acids, Humic Acids, Giberelin, Auxin, Sitokenin, and various elements of other nutrients that needed by all kinds of plants and animals (Falasifa et al.,2014).

Research of Arham et al., (2014) explains that the addition of liquid organic fertilizer influences on plant height components, leaf area, fresh weight, number of tubers per hill and fresh tuber weight of onion crop. Nurahmi et al., (2011) explains that the concentration of organic liquid fertilizer significantly affected the cocoa plant seedling height, leaf area, root length, fresh weight, and dry weight. Andrie KL et al., (2015) report that the administration of a liquid organic fertilizer significantly affected the length of cucumber plants, the number of fruits per plant, and fruit weight per plant.

II. RESEARCH METHODS

A. Study area

The research was conducted at the Experimental Station (Green House) Faculty of Agriculture, National University, Pasar Minggu, South Jakarta, Jakarta. This activity was conducted from March to June 2018.

B. Reasearch Material

The materials used are tomato seed varieties of tropical ruby, manure, chaff, liquid organic fertilizer from seaweed, and liquid organic fertilizer from organic ingredients. The tools used are hoes, rakes, shovels, yells, tray, polybag, tape measure, ruler, sprayer, labeling, analytical balance, oven, stationery, and a camera.

C. Procedures

This study will be conducted at the Green House. Research procedure includes:

I. Media PreparationPlant

Planting medium that will be used is soil + manure + chaff in the ratio 2: 1: 1. Before use, soil and manure dried for 1 week ± 1 Minggu. Since soil and manure filtered to obtain delicate parts are then mixed and put into polybags as 6 kg. After it is placed in polybags, placed into a greenhouse following the research plan (Annex 3) has been made, then the media doused with water and allowed to stand for ± 1 Sunday.

II. Seeding

Sowing tomato seeds advance in the nursery box (tray), seedbed media is a mixture of soil + manure + chaff in the ratio (1: 1: 1). Watering should be done by spray (sprayer). Polybag seedlings are transferred into that already contain growing media after ± 2-week-old seedlings have 4-5 leaves.

III. Applications of Liquid Organic Fertilizer

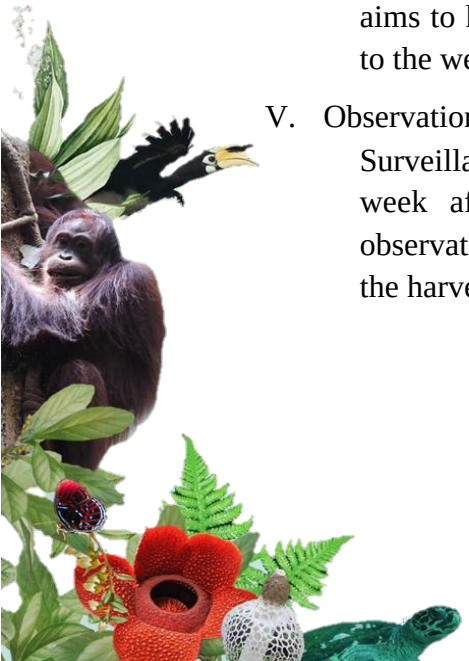
Liquid organic fertilizer applications conducted a week after the plant was moved to a polybag. Liquid organic fertilizer treatment, with doses of 0 ml, 0.5 ml, 1 ml, and 1.5 ml.

IV. Maintenance

Stitching is done 3 days after the plant was moved to polybags if there are plants that die. Watering is done (1-2) times a day. Weeding is done by pulling the weeds in a polybag. Pruning is done to the unproductive branches, shoots, shoots the main stem, in part pests and diseases of old leaves. Giving marker performed when the plant reaches a height of 20 cm, giving stakes aims to help the plants grow upright, reducing physical damage to crops due to the weight of the fruit andwind.

V. Observation

Surveillance activities carried out every ten days. The bservation started a week after being given treatment liquid organic fertilizer, except the observation of root length, root dry weight, number of pieces, performed after the harvest.



VI. Harvest

Harvesting is done when the fruit is already quite old, is characterized by changes from green to red fruit. Harvesting is done by picked and grouped by treatment tested

The Observation Variables,

1. **Number of Leaves andFlowers**

   The number of leaves and flowers is observed by counting the number of leaves and flowers that grow on each plant. Observations were carried out the amount of leaves at the ages of 20, 40, and 60 days after planting, while the amount of interests at the ages of 60, 70, 80 and 90 HST

2. **Number of Fruits and FruitWeight**

   The numbers of fruit and fruit weights were observed after the harvest period by calculating a lot of fruit and fruit weighed on a balance, then grouped according to the treatments tested.

D. DataAnalysis

This research is compiled in a randomized block design (RBD) in a factorial pattern. Consisting of two factors: the first factor is the type of liquid organic fertilizer (P) which consists of two levels, ie liquid organic fertilizer from seaweed (P1) and liquid organic fertilizer from organic materials (P2) and the second factor is the dose of a liquid organic fertilizer (D) which consists of four levels. Of the two factors obtained eight treatment combinations as follows: P1D0, P1D1, P1D2, P1D3, P2D0, P2D1, P2D2, P2D3. Eight combinations of these treatments each repeated three times in groups so that overall there are 24 experimental units. The data obtained were statistically processed and tested further by The Least Significant Difference test at a 5%level.

Financial Analysis

Cost of Production and Farmers Income Tomato Plants

The cost of production in the cultivation of tomatoes consists of variable costs (variable costs) and fixed costs (fixed cost). The variable cost (variable cost) consists of the purchase cost of production inputs, labor outside the family (TKLK), and transportation. Fixed costs (fixed cost) consist of labor costs in the family (TKDK) and depreciation of equipment and building manufacture.
The total cost is the sum of total fixed costs (TFC) and total variable cost (TVC). Formulation of the total costs as follows:

TC = TFC + TVC

Information :

TC = The total cost agro-year effort (USD / month)
TFC = Total fixed costs agroindustry know (USD / month)
TVC = Total variable costs agroindustry know (USD /month)

Acceptance (Revenue)

Total revenue (total revenue) of a business can be obtained by multiplying the amount of output produced (sold) at a price Mathematically written acceptance by the formula:

TR = P x Q

Information :

TR = Total revenue agroindustry (USD / month)
P = Price per kilogram (US $)

Profit (Profit)

Businessman business profits are the final result of revenue minus the total cost of production. Mathematically advantage denoted by the formula:

π = TR - TC

Information :

Π = Profit (USD /month)
TR = Total Revenue (USD / month)
TC = Total Cost (USD /month)

Profitability

Profitability is the ratio between the profit from the sale of a total cost expressed as a percentage. Mathematically can be formulated as follows:

$$\textbf{profitability} = \frac{Keuntungan}{TC} \; x \; 100\%$$

Information:

Π = Advantages of agro-industrial enterprises (USD / month)
TC = The total cost of agro-industrial enterprises (USD /month)

According to Gasperz (1999) in Sutoyo (2009), criteria used in the assessment of profitability are profitability> 0 means that cultivated favorable agro-industry, agro-industry profitability = 0 means that cultivated BEP and profitability <0 means unfavorable agro-industry.

Analysis of Business Efficiency

Business efficiency calculations used are Revenue Cost Ratio (R / C Ratio). R / C Ratio is the ratio between revenue and costs. Mathematically be written asfollows:

$$\textbf{R / C ratio} = \frac{Total\ Penerimaan\ (TR)}{Total\ Biaya\ (TC)}$$

Where:
If the R / C> 1 then the cultivation of tomatoes profitable.
If the R / C <1 then the cultivation of tomatoes are not beneficial
If the R / C = 1 then the cultivation of tomatoes to break even, which is the effort gives the same amount of revenue by the number of issues.

III. RESULTS AND DISCUSSION

According to The Central Bureau of Statistics (2016) research locations in Jati Padang village located at an altitude of 26.2 meters above sea level, the average rainfall reached 13.9 mm / day, 81% humidity, the intensity of solar radiation and temperature 52% 24, 3 ° C until 32,2oC.

Number of Leaves

The observation number of leaves done three times with an interval of the observation of 20 days ie at the age of 20 days after planting (DAP) to the plant, was 60 HST. The number of leaves calculated by units (pieces). The results of the research application type and dosage of liquid organic fertilizer to the number of leaves of 20-60 HST can be seen in Table 2.

The influence of the type of liquid organic fertilizer to the number of leaves on tomato plants look different between fertilizer from seaweed fertilizer organic materials where the influence of organic fertilizer from seaweed number of leaves more or significantly different. It is suspected because of the influence of organic fertilizer from seaweed that is very easily absorbed by plants. This statement is supported by the opinion of Poerwowidodo in Patricia et al., (2015) which states that the genetic patterns determine the potential for plants to grow up. Januwari et al., (1994) adds that genetic factors actually influence the number of leaves, these factors play a role in the speed of plant growth, so although given treatment growing environment that is different but the role of genetics looks dominant influence on the number of leaves of plants (Nasrulloh et al., 2016).

Table 2. Effect of application type and dose of Liquid Organic Fertilizer on Tomato Plant Leaf Number

Treatment Type of Liquid Organic Fertilizer	Number of leaves (leaf)		
	20 HST	40 HST	60 HST
Seaweed	30.04 b	65.34 b	146.54 b
Organic ingredients	24.81 a	59.38 a	139.63 a
Dose Organic Fertilizer			
0 ml	22:16 a	41.30 a	108.23 a
0.5 ml	26.00 b	61.83 b	139.89 b
1.0 ml	36.00 c	71.83 c	149.00 c
1.5 ml	29.67 c	70.00 c	148.33 c

Description: Angka followed by the same letter in the same column are not significantly different by LSD at 5% level. 2.HST: days after planting.

Number of Flowers and Fruit

Flower formation is the transition from the vegetative phase to the generative phase. The results of the research application type and dosage of liquid organic fertilizer to the amount of interest of 20-60 HST can be seen in Table 3.

Table 3. Effect of application type and dose of Liquid Organic Fertilizer to Number of Tomato Plants Flowers

Treatment Type of Liquid Organic Fertilizer	Total interest (Florets)	Total Fruit
Seaweed	66.08 a	46.58 a
Organic ingredients	49.25 b	40.50 b
Dose Organic Fertilizer		
0 ml	52.83 a	41.67 a
0.5 ml	64.50 b	52.33 b
1.0 ml	75.17 c	63.83 c
1.5 ml	62.17 b	51.33 b

Description: Figures followed by the same letter in the same column are not significantly different by LSD at 5% level.

The results of variance showed that the interaction between the type of liquid organic fertilizer with significantly different dosages on the number of flowers and fruits of the tomato plant. The treatment of different types of liquid organic fertilizer significantlyaffectedthenumberofflowersandfruitsaswellasoverdosageofliquid

organic fertilizer also significantly different from the number of flowers and fruits of the tomato plant. Nutrients most needed by the tomato plant at flowering are phosphorus and potassium. Wiryanta in Patricia et al., (2015) states that the function of phosphorus is for the growth of flowers and ripening fruit, shortage of phosphorus on tomato plants will cause disturbed generative growth. Phallus (2006) adds that the element potassium acts to activate the work of some enzymes, accelerate the distribution of carbohydrates from leaves to other plant organs one of them in flower formation. While Darjanto and Satifah in Patricia et al., (2015) stated that genetic factors partly determine the transition from the vegetative to the generative phase and partly determined by environmental factors such as temperature, light humidity, andnutrients.

Fruit Weight of Tomato

The results of variance showed that the interaction between the delivery of this type of liquid organic fertilizer with a dose of liquid organic fertilizer significantly different with a fruit weight of tomato plants. Effect of application types and doses of liquid organic fertilizer to the amount of tomato fruit weight (Table 4).

Table 4.Pengaruh application type and dose of Liquid Organic Fertilizer to the amount of fruit and BuahTomat Weight per Plant

Treatment Type of Liquid Organic Fertilizer	Fruit Weight of Tomato Per plant (g)
Seaweed	1204.50 b
Organic ingredients	1009.43 a
Dose Organic Fertilizer	
0 ml	796.80 a
0.5 ml	1185.90 b
1.0 ml	1412.27 c
1.5 ml	1142.80 b

Description : Figures followed by the same letter in the same column are not significantly different by LSD at 5% level.

Liquid organic fertilizer treatment from seaweed has a very significant effect on increasing the weight of tomatoes, while the most appropriate dose is the dose of 1 ml of planting, which produces the highest fruit weight. This is presumably due to the number and weight of tomatoes affected by fotosintat intake resulting from the process of photosynthesis that occurs in the leaves. The number of leaves was significantly differentamongalltreatmentscausefotosintatproducedmanyleavesarealsodifferent,

so the number and weight of tomatoes is also significantly different. This statement is supported by the opinion Wahyudi, (2012), which states that good leaf growth in the vegetative phase generative phase affects the photosynthesis of the plant because the leaves are well capable of supplying fotosintat for optimum fruit development.

Cost and Revenue Analysis of Tomato Cultivation

Table 5. Cost and Revenue Analysis of Tomato Cultivation per Hectare

No.	commentary	conventional	Organic fertilizer Seaweed
1	Land lease	8,000,000	8,000,000
2	Saprotan	16.95065 million	16.50065 million
3	Shrinkage	457 045	457 045
4	Labor pesticide spraying	3.19 million	3.19 million
5	Organic fertilizer Seaweed 20 lx 96.000		1.92 million
6	Total Cost of Production	28,597,695	30,067,695
	Reception		
	28 240 X 3000		84.72 million
	15 972 X3.000	47.916 million	
	Profit / Ha	19,318,305	54,652,305
	Earnings per month	3863661	10,930,461
	R / C ratio	1.68	2,82

The results of the analysis of costs and revenues seen that by utilizing a liquid organic fertilizer, which is derived from seaweed farmer's incomes increase tomato plants from Rp. 19,318,305, - to Rp. 54,652,305, - an increase of 182.90%. This is because the production costs for the purchase of organic liquid seaweed fertilizer is not too expensive compared to the increase in production by using organic fertilizer seaweed amounted to 12 268 kg. The value R / C ratio also increased from 1.68 to 2.82. R / C increased substantially also is an indicator of an increase in farmers' income significantly. However, the reality in the field is still a difficult application to farmers. Results socialization of organic seaweed fertilizer to farmers enough serious attention if farmerswanttodosoearnestlywillincreasetheincomeoffarmingfamiliesis

significant. Therefore it is essential socialization of organic seaweed fertilizer to the manufacture of demonstration plots can be a real example for tomato growers.

IV. CONCLUSIONS AND RECOMMENDATION

A. Conclusion

The use of liquid organic fertilizer seaweed boosts the amount of leaf, flower number, and the number of pieces of tomato plants. The weight of tomatoes increased from 15 972 kg to 28 240 kg per hectare, up 76.80%. While the financial terms of farmers' incomes increase from Rp. 19,318,305, - to Rp. 54,652,305, - an increase of 182.90%.

B. Recommendation

It is advisable in future studies to try utilization of organic fertilizer seaweed on other vegetable crops

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ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED TO TREAT HUMAN DISEASES IN REJANG TRIBE, SEKAYUN MUDIK VILLAGE, BENGKULU, INDONESIA

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Abstract

This study documents information on significant ethnomedicinal plants, which was collected from traditional healers of Rejang tribe in Sekayun Mudik village of Bengkulu. The study focused on documentation of medicinal plants used to treat various human diseases in the study area. The information was obtained through open-ended, semi strucutral questionnaires and guided field walks. A total of 32 ethnomedicinal plants species, which were distributed in 25 families used to treat 32 human diseases in the community. Of these, 18 species were obtained from the wild ecosystem, and 14 plants were cultivated. Of a majority of documented species, herbs and leaves were the most utilized plant parts for the preparation of ethnomedicinal (60%). Concerning the traditional method of drug preparation, the decoction was the most community utilized. Among the documented species, the dominant families were Acanthaceae, Arecaceae, Euphorbiaceae, Lamiaceae, Poaceae, Rutaceae and Zingiberaceae with 2 species respectively. The plant that presented a major relative importance were *Murraya paniculata*,*Curcuma longa,Jatropha curcas*, *Orthosiphon stamineus, Piper betle* and *Zingiber officinale* . Effort to conserve and cultivate medicinal plants is non existent. To save medicinal plants from further loss, involving local communities in cultivation of the most utilized medicinal plants is recommended.

Keywords : Bengkulu, medicinal plants, rejang tribe, Sekayun Mudik village, traditional knowledge

I. INTRODUCTION

Medicinal plants have important contributions in the healthcare system of local communities as the main source of medicinal for the majority of the rural population (Abbink, 1995). According to data from the World Health Organization (WHO), about 80% of the world's population, especially the rural people of developing countries, still primarily rely on traditional medicine (Islam, 2006).

Ethnomedicinal knowledge is usually passed verbally from one generation to the next through family members (Nadembega et al, 2011) and most of this knowledge has not been formally documented (Asase et al, 2008). Adequate information of such knowledge, and especially of traditional ethnomedicinal practices is important because

ethnomedicinal healers have a long association with herbs and their medical properties (Kabir et al, 2014). The knowledge and use of plants is an integral part of many ethnic rural cultures, such as Rejang tribe in Bengkulu District, the extent of which has not yet been studied in depth (Pei et al, 2009).

On a world wide scale, due to the globalization trend, the traditional knowledge including that regarding the medicinal plants, vanishes and get lost even more. The use of synthetic and artificial products is on the rise and at the same time indigenous plant species are replaced with introduced ones which push out the plant use traditionally (Koleva et al, 2015). More over, in recent years there has been a continous decline in traditional medicinal practices, because of reduced intertest in the younger generation toward traditional treatment system. These factors have contributed to the rapid loss of this rich knowledge (Kader et al, 2013). It is, therefore necessary tp preserve this indigenous knowledge on traditional medicine by proper documentation, identification of plant species used and herbal preparation. To save medicinal plants from further loss, involving local communities in cultivation of the most utilized medicinal plants is recommended.

II. RESEARCH METHODS

A. StudyArea

The study was carried out in Rejang community located in Sekayun Mudik Village, Bengkulu District. The village is about 32 km far from Bengkulu. Bengkulu is a lowland district with an area of 70.71 km sq. km, between 102°11’24” - 102°37’12” East longitude and 3°28’48” - 3° 5’36” South Latitude. The economy of this village is predominantly agricultural and plantation. Climate within the village is typically wet climate, the average annual rainfall is 3.394 mm.

B. Field Study and Data Collection

The field survey was carried out from December 2018 to January 2019 at Rejang community in Sekayun Mudik village, Bengkulu District. A total of 32 (9 males and 23 females) informant were interviewed in the study area, in which all thge informants were selected purposively based on the recommendation of knowledgeable elders and local authorities. All of the informants were local inhabitants. The information was mostly provided by adult woman (72%) because thgey usually know the plants better than men and younger people. They provided useful and firsthand information on the popular use of medicinal plants. Males (28%) were also interviewd to examine their medicinalknowledge.

Ethnobotanical investigation were carried out to collect data on medicinal plants use to treat human ailment. The methodological approaches weresemi-structured

interview, field observation and guided field walks. Interviews and discussion based on a checklist of questionnare. Information was carefully recorded during interviews with each informant. Field observations were performed with traditional healers guided on the morphological features and habitats of each medicinal plant species. The information obtained was cross-checked with other informants. The information such as local name, habit, wild/cultivation, availability of medicinal plants and traditional medicinal usesof plants wererecorded.

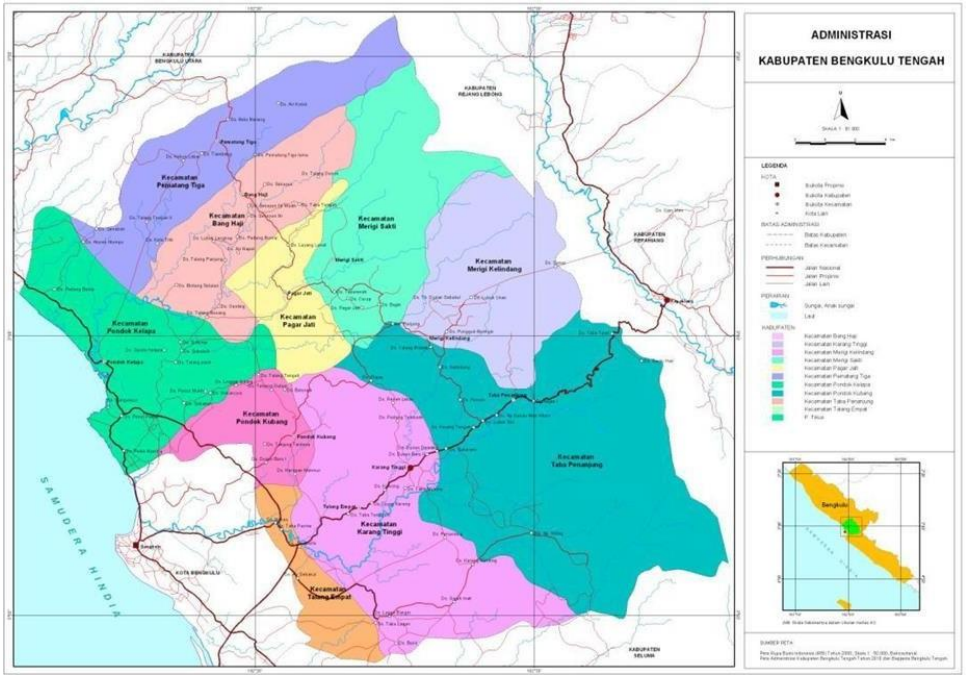


Figure 1. A map of the study area

III. RESULTS AND DISCUSSION

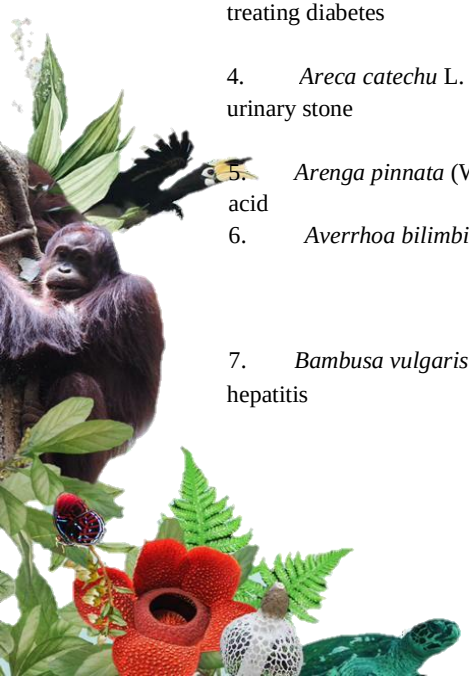
A. Medicinal plants of the study Area

The results showed that the people of Rejang tribe in Sekayun Mudik village have used 32 medicinal plants belong to 32 genera and 24 families to treat 32 human ailment (Table 1.). Of these 32 species of medicinbal plants collected from the study area, most of them 18 (56,3%) were obtained from the wild habitats whereas 14 (43,7%) werte from home garden. The majority of plants used as medicine were freely harvesteds by traditional healers from natural environment. Generally fresh part were wild harvest. The plant family are dominated by Lamiaceae, Acanthaceae, Arecaceae, Euphorbiaceae, Fabaceae, Poaceae and Zingiberaceae with 2 species (6,25%) respectively (Figure1.). Similar results were reported by other ethnobotanist, Silalahi andNisyawati(2018).SilalahiandNisyawati(2018)reportedthatthetopfivelargest

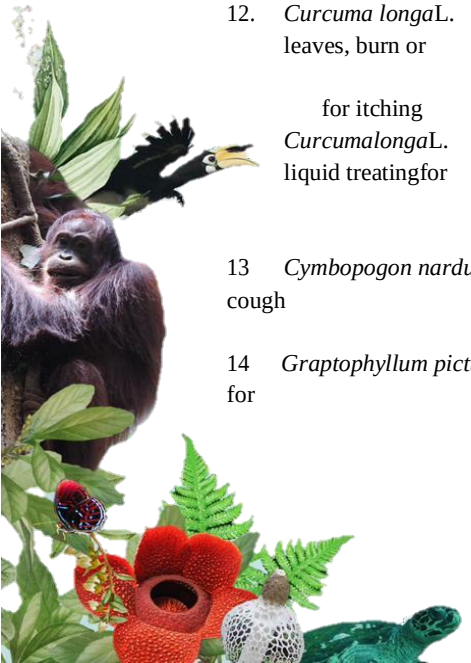
families in the home garden of Batak Karo in North Sumatra, Indonesia are the Zingiberacea, Poaceae, Fabaceae, Arecaceae and Acanthaceae. Similar results wee reported by other ethnobotanist (Khastini *et al*, 2019). Khastini *et al* (2019) according to them, that Lamiaceae, Acanthaceae, Arecaceae, Euphorbiaceae, Fabaceae, Poaceae and Zingiberaceae were the dominant families. The dominance of Lamiaceae species in treating ailments may be due to the richness in essential oil (Nieto, 2017) that have both diuretic and vasodilator effect (Adam *et al*, 2009). It was found that, *Murraya paniculata*, *Curcuma longa*, *Jatropha curcas*, *Orthosiphon stamineus*, *Piper betle* and *Zingiber officinale* were the most commonly used species (Table 1).

Table 1. Inventory of Medicinal Plants Traditionally Used by People in Rejang tribe of Sekayun Mudik Village, Bengkulu

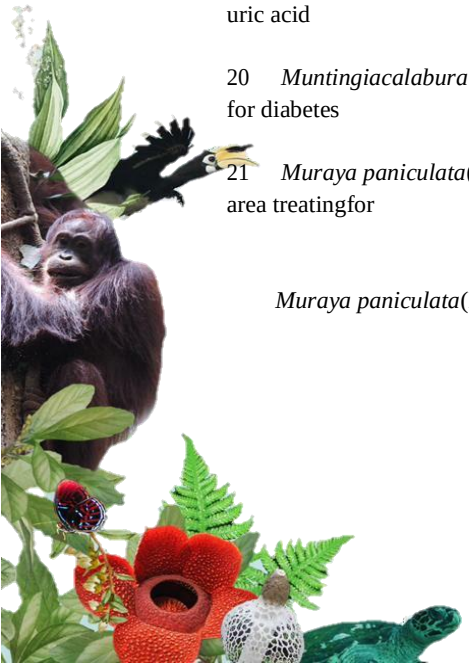
No.	Scientific name	Local name	Family	Life form	Part used	Preparation and uses
1	*Aloe vera* (L.) Burm.f and *Aloe vera* (L.) Burm.f	Lidah buaya Lidah buaya	Asphodelaceae Asphodelaceae	Herb Herb	Leaves Leaves	Mucus from inside of leaves. add a little salt, applied on affected treating for ulcer Mucus from inside of leaves, and applied on affected are treating for burn wound
2.	*Andrographis paniculata* Nees	Sambiloto	Acanthaceae	Herb	Leaves	Boiled with water and drunk he liquid for treating typhus
	Andrographis paniculata Nees	Sambiloto	Acanthaceae	Herb	Leaves	Squeezed the fresh part, drunk the liquid for treating fever
3.	*Annona muricata* L.	Srikayo	Annonaceae	Herb	Leaves	Boiled with water and drunk the liquid for treating diabetes
4.	*Areca catechu* L.	Punbakeak	Arecaceae	Tree	Youngstem	Boiled with water, taken orally treatingfor urinary stone
5.	*Arenga pinnata* (Wurmb.)Merr.	Beluluk	Arecaceae	Tree	Fruit	Boiled with water, taken orally treating for uric acid
6.	*Averrhoa bilimbi* L.	Belimbing	Oxalidaceae	Tree	Fruit	Boiled with water and drunk the liquid for treating hypertension
7.	*Bambusa vulgaris* Schrad.	Hawur kuning	Poaceae	Tree	Bud	Boiled with water, taken orally for treating hepatitis



8.	*Caricapapaya*L.	Sangsilo	Caricaceae	Tree	Leaves	Squeeze the fresh part, add alittle salt and duink theliquid for treatingmalaria
	C*aricapapaya*l.	Sangsilo	Caricaceae	Tree	Seeds	Grinding, decoction,drunk the liquid for treatingintestinal worms
9	*Catharathus roseus*(L.)G.Don	Tapakdara	Apocynaceae	Herb	Leaves	Pound fresh part, applied on the affected area treatingfor Burn wound
10.	*Citrusaurantifolia*Swingle	Jeruknipis	Rutaceae	Tree	Fruit	Squeezed, and drunk the liquid for ttreating cough
	*Citrusaurantifolia*Swingle	Jeruknipis	Rutaceae	Tree	Fruit	Squeezed the fresh part, the liquid mix with lime betel applied on the armpit and clean with water treating for reducing body odor
11.	*Colocasia esculenta* (L.)Schott.	Keladi	Araceae	Herb	Petiole	Sap of petipole, applied on affected area treating for cut wound
12.	*Curcuma longa*L.	Beikunik	Zingiberaceae	Herb	Rhizome	Shredded the fresh part, enveloped by banana leaves, burn or set on fire, applied on the affected area treating for itching
	*Curcumalonga*L.	Beikunik	Zingiberaceae	Herb	Rhizome	Shredded the fresh part. Squeezed, drunk the liquid treatingfor gastricism
13	*Cymbopogon nardus*(L.)Rendle	Serai	Poaceae	Herb	Leaves	Boiled with water, drunk the liquid treating for cough
14	*Graptophyllum pictum*(L.)Griff.	Daunungu	Acanthaceae	Shrub	Leaves	Boiled with water and drunk the liquid treating for

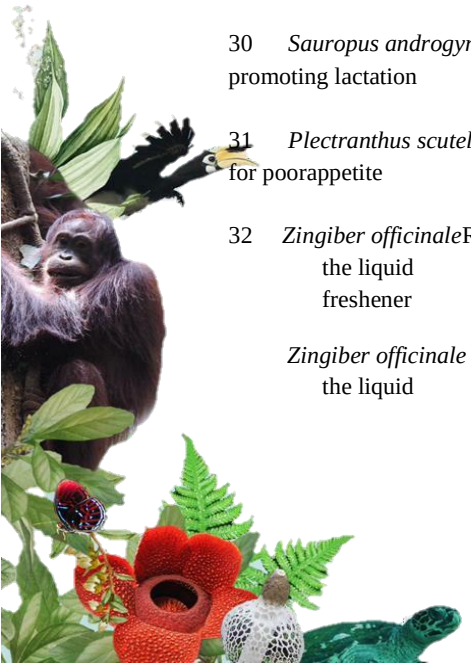


						promoting menstruation after birth.
15	*Hibiscusrosa-sinensis*L.	Kembangrayo	Malvaceae	Shrub	Leaves	Boiled with water and drunk the liquid treating for excessive bleeding during menstruation dan childbirth.
16	*Impatiensbalsamina*L.	Pacarair	Balsaminaceae	Herb	Leaves	Pound the fresh part, applied on the affected area treatingfor burn wound
17	*Jatrophacurcas*L.	Jarakpagar	Euphorbiaceae	Shrub	Leaves	Smeared with vegetable oil, withered until warm appliedon abdomen treating for intestinal worm
	*Jatrophacurcas*L.	Jarakpagar	Euphorbiaceae	Shrub	Petiole	Sap of petiole applied on the affectedarea treating for sprue
18	*Leucaena leucocephala* (Lamk,) deWit	Petaicina	Fabaceae	Shrub	Seed	Fresh seeds consume daily treating for intestinal worms
19	*Limnocharis flava*(L.)Buchenau	Selayau	Limnocharitaceae	Herb	Leaves	Boiled with water and taken orally for treating uric acid
20	*Muntingiacalabura* L.	Seris	Muntingiaceae	Shrub	Leaves	Boiled with water and drunk the liquid treating for diabetes
21	*Muraya paniculata*(l.)Jack	Kemuning	Rutaceae	Shrub	Leaves	Pound the fresh part, applied on the affected area treatingfor sprain
	Muraya paniculata(L.)Jack	Kemuning	Rutaceae	Shrub	Leaves	Grinding, drunk the liquid treating forasthma



22	*Musabrachycarpa*Backer	**M**anakpisang	Musaceae	Herb	Flower	Boiled with water and taken orally for promoting lactation
23	*Myrmecodia pendens*Merr.&Perry	Sa'ang semut	Rubiaceae	Epiphyt	Bulb	Boiled with water and drunk the liquid treating fortumor
24	*Orthosiphonstamineus* Benth.	Kumis kucing	Lamiaceae	Herb	Leaves	Boiled with water and drunk the liquid treating for urinarystone
	*Orthosiphonstamineus*Benth.	Kumis kucing	Lamiaceae	Herb	Leaves	Boiled with water and drunk the liquid treating forhypertension
25	*Perseaamericana* Mill.	Jambeu mentega	Lauraceae	Tree	Leaves	Boiled with water and drunk the liquid twice a day treatingfor hypertension
26	*Phaleria macrocarpa*(Scheff.)Boerl.	Cempaka dewa	Thymelaeceae	Tree	Fruit	Flesh of fruit boiled with water, drunk the liquit treatingfor diabetes
27	*Piperbetle*L.	Daun iben	Piperaceae	Liana	Leaves	Fresh leaves soaked with warm water, treating for pain of eye
	*Piperbetle*L.	Daun iben	Piperaceae	Liana	Leaves	Boiled with water, and the liquid spashed on affected area treating for itching
	*Piperbetle*L.	Dauniben and other part	Piperaceae	Liana	Leaves	Boiled with water, and drunk some othe liquid used on affected area treating for vaginal discharge

Piper betle L.	Daun iben	Piperaceae	Liana	Leaves	Pound the fresh part, applied on the affected area treating for toothache
Piper betle L.	Daun iben	Piperaceae	Liana	Leaves	Frsh leaves chewed together with seed of betel nut, treating for strengthening teeth
28. *Pithecellobiumlobatum* Benth.	Jeing	Fabaceae	Tree	Leaves	Pound tghe fresh part applied on theaffected area, treating for ulcer,
29 *Psidium guajava* L.	Janmeutelung	Myrtaceae	Shrub	fruit	Pound the rind of young fruit, squeezed,drunk theliquid, treating for malaria
Psidium guajava L.	Janmeutelung	Myrtaceae	Shrub	leaves	Pounding the fresh part, squeezed, drunk the liquid treating for hemorrhoid
Psidium guajava L.	Janmeutelung	Myrtaceae	Shrub	leaves	Pounding the young leaves, squeezed, drunk the liquid treating for diarrhea
30 *Sauropus androgynus* (L.)Merr.	Katuk	Euphorbiaceae	Shrub	Leves	Boiled with water, taken orally treating for promoting lactation
31 *Plectranthus scutellaroides*(L.)R.Br.	Piung	Lamiaceae	Herb	Leaves	Boiled with water and drunk the liquid treating for poorappetite
32 *Zingiber officinale*Roscoe	Jahe	Zingiberaceae	Herb	Rhizome	Boiledwithwater,mixwithpalmsugar,drunk the liquid treating forbody freshener
Zingiber officinale Roscoe	Jahe	Zingiberaceae	Herb	Rhizome	Boiled with water, mix with palm sugar, drunk the liquid treating for relieve menstrual pain and



B. Growth Form of Medicinal Plants

The result of life frowth analysis of medicinal plants showed that herbaceous plants constituted the highest propportion represented by 12 (37,5%), while there were 10 (31,2%) tree species, 8 (25%) shrub spcesies, 1 (3,1%) liana and 1 (3,1%) epiphyte species (Figure 2). This finding shows that the most represented life forms of medicinal plants in the study area were herbs followed by tree. Similar result reported with analogous studies conducted elsewhere (Jima and Megersa 2018 : Kasrina et al, 2015). For instance, Juma and Megersa (2018) identified 48,6% herbs and 24,3% trees from Bale Zone of Oromia Regiene State in Berberic District, South East Ethiopia, while Kasrina et al (2015) documented 43,6% herbs and 25,6% trees from Mukomuko regency, Bengkulu province, Indonesia.

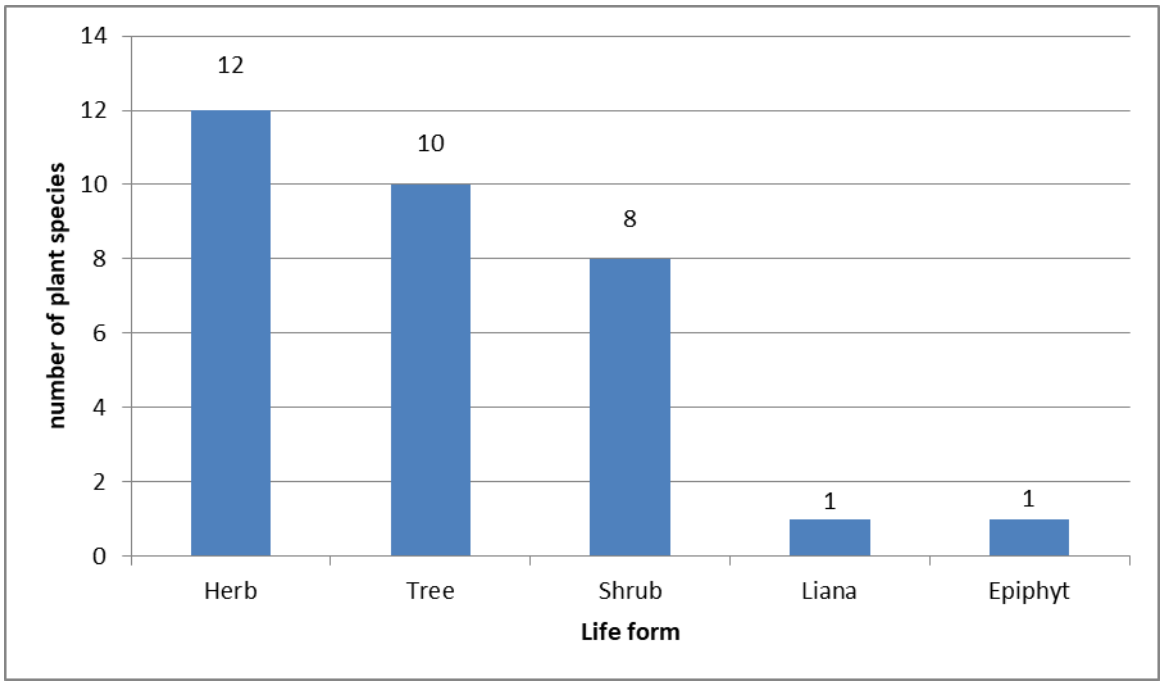


Figure 2. Life form of medicinal plants in the study area

C. Plant Part Used to Treat Human Diseases

People of the study area harvest different plant part for tge preparation of traditional remedies (e.g leaves, fruits, petiole, rhizome, young stem, bud, seeds and bulb). In the study area, 21 species (60%) were harvested for their leaves (Figure 3). This is because it is believed that leaves contain the highest medicinal properties and part of olant that most easily harvested. The finding of leaves as the contributorof

higher number of plant species used for medicinal purpose than other plant part is in line with similar study conducted by Malini *et al* (2017) in which leaves (51,8%) were reported as the most widely used plant part followed by stem (22,9%). The study conducted by Khan et al (2018) showed that leaves 41% as a major plant part used in the treatment of humanailment.

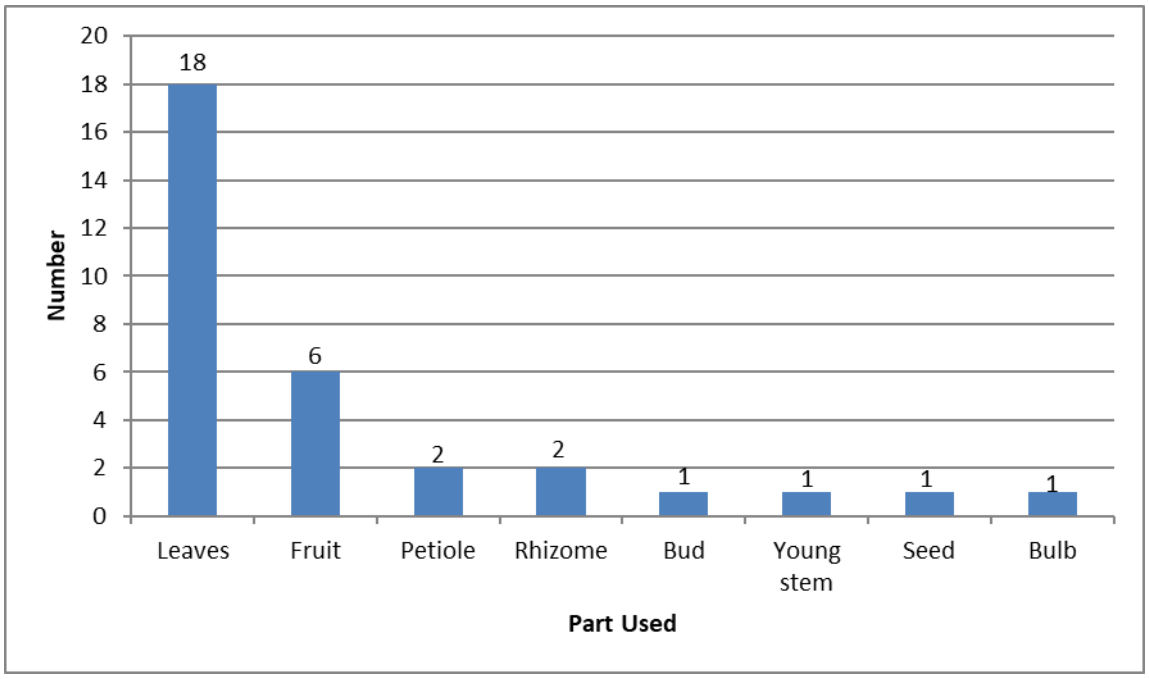


Figure 3. Plant part used for treatment of human ailment

D. Method of Preparation and Administration

In the collection of data concerning the preparation of medicine, Informants reported various skills associated with herbal preparation. The result showed that all remedies were prepared from a single plant. Similarly, various research findings reported the use of single plant species or parts for traditional remedy preparation (Nahdi et al. 2016 ; Zenebe et al. 2012) Most of the medicinal plant preparations involved the use of single plant species or a single plant part while thosemixing different plant parts were less encountered in the study area. The dependency of local people on fresh material is mostly due to the effectiveness of fresh medicinal plant in treatment as the content are not lost before use compared to the driedforms.

The local communities employ various method of preparation of traditional medicines for different type of diseases. The preparation vary based on the type and actual site of diseases treated. The principal methods of remedy preparation were reported to be through decoction for 21 preparations (65,7%) powdering accounted for 6 preparation (18,7%) and squeezing accounted for 5 preparation (15,6%). Decoction asthemostcommonmodeofpreparationisinagreementwiththefindingsofPacifica

et al (2018) and Taek et al (2019) who noted that the principal method of remwdy preparation was through decoction.

Medicinal plants were applied through different routes of administration (Table 1). In the study area, the substantial proportion of prescription were administered orally (67,4%), followed by external application (30,2%) and chewing (2,3%). This result is in line with the findings of Malini et.al. (2017) and Khan et al, (2018). Internal aliment were commonly tretaed b y making the patient drink herbal preparations; tooth infection was treated by pounding and applies on the affected area on the tooth surface; skin infections such as ulcer werte treated by creaming herbal preparation on an infected skin.

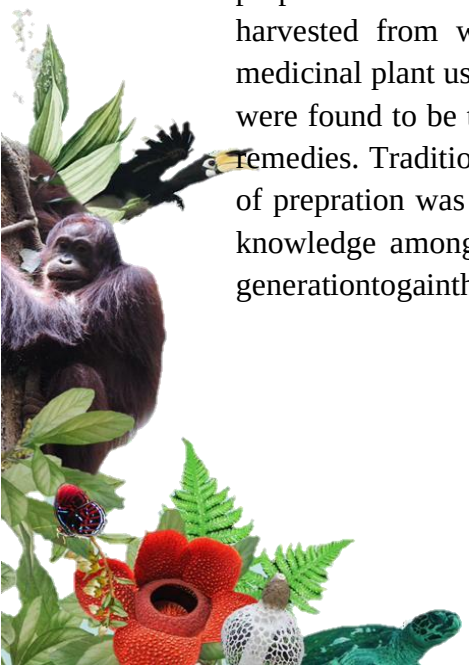
E. Diseases Treated in the Study Area

The medicinal plants were used to treat 32 human ailments in the study area. With regard to human diseases, Diabetes, intestinal worms, hypertension and burns wound were diseases wich a higher number of medicinal plants (3 species) were prescribeds, follow by cough, ulcer, urinary stone, uric acid, malaria, itching, promoting lactation Bone problem were treated with one species, *Murayya paniculata*. Skin problem with 7 species (21,9%) used for treatment, and respiratory problem were treated with one species, *Murraya paniculata* (Table1).

IV. CONCLUSIONS AND RECOMMENDATION

A. Conclusion

A study on medicinal plant utilization in area revealed that Rejang communities of Sekayun Mudik village use the medicinal plants for maintaning their primary healthcare, The study resulted in documenting 32 medicinal plants species where some families, e,g Acanthaceae, Arecaceae, Fabaceae, Euphorbiaceae, Lamiaceae, Poaceae and Zingioberaceae are the leading family with the highest proportionof medicinal plants. Most of (18) medicinal plants in the study area were harvested from wild habitats. Herbs were found to be dominant growth from of medicinal plant used for preparation traditional remedies and followed by trees. Leaves were found to be the most frequently used plant parts for the preparation of traditional remedies. Traditional medicinal preparation mostly involves a single plant and method of prepration was mainly decoction, foolowed by powdering. Depletion of indigenous knowledge among the people of study area was serious due to disinterest of young generationtogaintheknowledge.Efforttoconservetheplantsandassociated



indigenous knowledge was observed to be very poor. Conservation of medicinal plants by local communities is vital to avoidloss.

B. Recommendation

Medicinal plants played a significant role in healing human disorder in Rejang community of Sekayun Mudik village, Bengkulu. However, agricultural expansion and disinterest of young generation resulted in the reduction or loss both medicinal plants and associated indigenous knowledge. It is, therefore, necessary to preserve indigenous knowlwdge on traditional medicines by proper documentation, identification of plant used and herbal preparation. To safe medicinal plants for further loss, involving local communities in cultivation of the most utilized medicinal plants is recommended.

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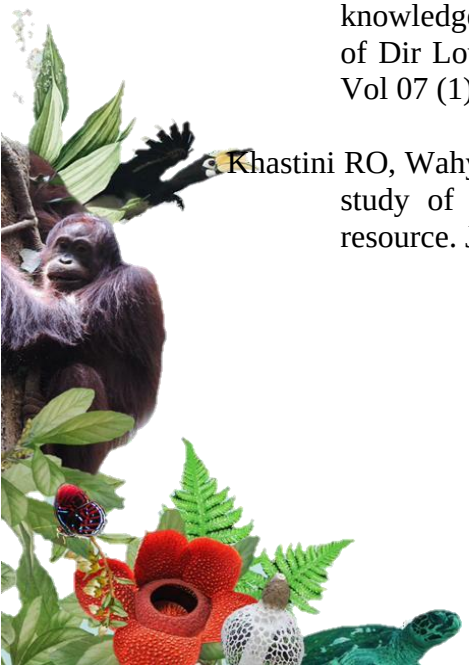

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UTILIZATION OF ORGANIC GROWTH HORMONE TO BOOST PRODUCTION OF CASSAVA SUPERIOR SEED SELECTION OF EXPLORATION RESULTS

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Abstract

Cassava is a commodity that deserves to be developed in Indonesia Because It has potential as a raw material for various processed products. Cassava product development will support sustainable agriculture and improve the welfare of the community. The aim of the research was to find some varieties of cassava with high productivity and resistance to drought and pest attack, the resulting in a combination of fertilization and growth hormone that is Appropriate to increase of cassava production more than 40 tons per hectare, discover new varieties of cassava with superior productivity of more than 40 tonnes per hectare and analyze the financial feasibility of farming cassava. The survey results will be Obtained four varieties of cassava with high productivity and adaptive. Reviews These four types of cassava will be tested with four semi-organic fertilizer treatments and growth hormones. There are four levels of fertilization treatment, i.e., chicken manure 10 tonnes/ha, chicken manure 10 t / ha application of granules and Organox Bioekstrim, chicken manure 15 tonnes/ha and fertilizer granule Bioekstrim 2 tonnes/ha and Organox. Farming cassava varieties elephants and Manggu results by using manure and organic hormone could increase the average production of the variety Manggu tonnes/ha. And varieties of elephants at 40.50 tonnes/ha. Elephant farm and Manggu cassava cultivation with fertilizing manure and organic hormone feasible with a value of R / C ratio of 2.94 and3.72.

Keywords: cassava, growth hormone, organic, quality seeds

I. INTRODUCTION

Cassava (*Manihot esculenta Crantz*) or cassava or manioc is a plant cultivated as a staple food after rice and maize in Indonesia. Cassava leaves as a vegetable material that has a high enough protein, or for other purposes such as pharmaceuticals. The wood can be used as garden fences or used as firewood for cooking. Cassava used as basic materials for the food industry and feed industry raw materials (Salim, 2011). In addition to high carbohydrates can also be used as bioethanol, cassava, tapioca, and the drugindustry.

Cassava is a commodity that deserves to be developed in Indonesia because it has potential as a raw material for various processed products. Besides the availability of large tracts of land, climate, and soil suitable for developing the cassava commodity. Moreover, these plants can grow well in high and low-lying and knows no season. Therefore,Indonesiahasatremendouspotentialtodevelopproductsbasedoncassava.

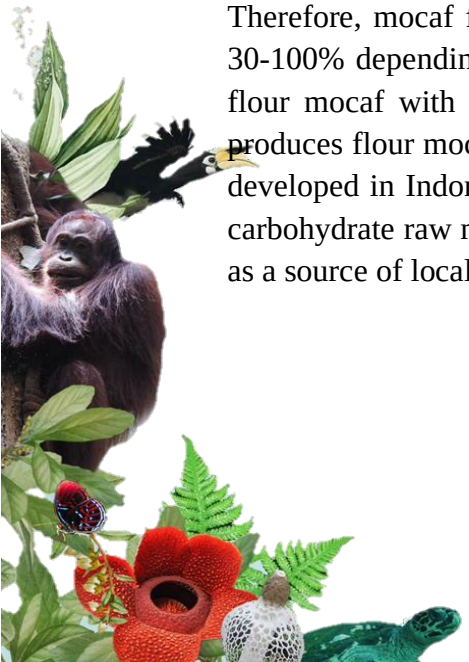
Cassava product development will support sustainable agriculture and improve the welfare of the community.

Cassava plants have high levels of production, physical and chemical properties that vary according to the level of soil fertility cassava planting site. Location planting and harvesting of different ages will produce different physical and chemical properties. Cassava contains a reasonably high starch content. Quality Cassava is strongly influenced by the type, age, grow, care and fertilization when the cultivation period. The Cassava ages which have been ready for harvest between 7- 9months.

Cassava is used for many interests, such as industrial raw materials household, ie tapioca, mocaf, chips, slondok/lanting for family food stocks. Varieties of cassava that are used as raw materials by local craftsmen starch is a Lambong type. These varieties of cassava, farmers also used as materials for *oyek* for food reserves during the dryseason

Research Baafi (2008) on cassava cultivation technology needs to be focused on testing the suitability of the existing clones on the conditions of agricultural land and the purpose of production (food or bioenergy), test the various technologies cultivation to optimize production, including by utilizing biological fertilizer. This matter shows that the interaction of genetics and the environment is genuinely increasing in cassava production. The survey results Supanjani (2012) explains that the high production of cassava which allegedly is the contribution of technology application from the clones, the comprehensive land management and administration of the chicken manure 10 t / ha can result in the production of 75 ton/ha even without control of nuisance organisms. Productivity is still better than the highest production (60 tons/ha) reported by Asnawi (2007) in Lampung in the research introduction planting a double row. Meanwhile, according to Bantacut (2009) increased productivity can begin with changing the image cassava on the food of the poor into a prestigious food and accompanied by the implementation of policies encourage the development of food alternative energy and bio-ethanol fromcassava

Mocaf flour is one of the flagship products of cassava processing that is capable of supporting national food sovereignty. Mocaf is cassava flour fermented with lactic acid bacteria to produce cassava flour that has a good quality that does not smell cassava, finer, whiter, durable, compared with regular cassava starch or cassava flour. Therefore, mocaf flour (modified cassava flour) can be used to substitute wheat flour 30-100% depending on the type of product to be made. Currently, the manufacture of flour mocaf with fermentation technique using bacteria Acetobacter xylinum, which produces flour mocaf whiter and longer shelf. Therefore flour mocaf very feasibly to be developed in Indonesia. The high price of flour then has to seek alternative sources of carbohydrate raw materials cheaper substitute for wheat flour. Cassava has the potential as a source of local carbohydrate substitutes for wheat (Subagio,2007).



II. RESEARCH METHODS

A. Study Area

This study was conducted using a survey of varieties of cassava, the productivity of cassava and cassava prices for farmers and traders on the price in some cassava production centers in West Java Province, The research was conducted in January to December 2018.

B. Material Research

The questionnaire was delivered to farmers in cassava production centers in West Java. Two types of superior cassava seeds and adaptive. The land for the cultivation of cassava and organic fertilizers and growth hormones (Bioekstrim granules, Organox, Hormax, Bomax, and milk powder).

C. Procedures

The questionnaire submitted to the farmers to obtain information on the identity of the genotype/clone, the local name, which gained seed, and the reasons for their choice and the data on cultivation techniques (how to land management, plant maintenance, and harvest). Seleksi of seeds of the varieties of cassava with a productivity of more than 40 tons/ha in West Java. The result of the selection of seeds will be two types of cassava with high productivity and adaptive. Both types of cassava will be tested with four semi-organic fertilizer treatment and growth hormones (Bioekstrim granules, Organox, Hormax, Bomax, and milk powder). Fertilization treatment that the farmers combined with the organic hormone bioekstrim granule 2 tonnes/ha and organox. The research results will be obtained varieties of cassava with a productivity of more than 40 tons/ha, resistant to drought and pestsdiseases.

D. Data Analysis

Structured interviews on cassava farmers obtained primary data. Moreover, secondary data obtained from BPS and related institutions. The data collected, tabulated and analyzed with descriptive statistics include frequency analysis and cross-tabulation.

Financial Analysis

The cost of production in cassava cultivation consists of variable costs (variable costs) and fixed costs (fixed cost). The variable cost (variable cost) consists of the purchase cost of production inputs, labor outside the family (TKLK), and transportation. Fixed costs (fixed cost) consist of labor costs in the family (TKDK) and depreciation of equipment and buildingmanufacture.

The total cost is the sum of total fixed costs (TFC) and total variable cost (TVC). Formulation of the total costs as follows:

$$TC = TFC + TVC$$

Information:

TC = The total cost agro-year effort (USD /month)
TFC = Total fixed costs agroindustry know (USD / month)
TVC = Total variable costs agroindustry know (USD / month)

Acceptance (Revenue)

Total revenue (total revenue) of a business can be obtained by multiplying the amount of output produced (sold) at a price Mathematically written acceptance by theformula:

$$TR = P \times Q$$

Information:

TR = Total revenue agroindustry (USD / month)
P = Price per kilogram (US $)

Profit (Profit)

Businessman business profits are the final result in revenue minus the total cost of production. Mathematically advantage denoted by theformula:

$$\pi = TR - TC$$

Information:

Π = Profit (USD /month)
TR = Total Revenue (USD / month)
TC = Total Cost (USD /month)

Profitability

Profitability is the ratio between the profit from the sale of a total cost expressed as a percentage. Mathematically can be formulated as follows:

$$\text{profitability} = \frac{Keuntungan}{TC} \; x \; 100\%$$

Information:

Π = Advantages of agro-industrial enterprises (USD / month)
TC = The total cost of agro-industrial enterprises (USD /month)

According to Gasperz (1999) in Sutoyo (2009) criteria used in the assessment of profitability are: profitability> 0 means that cultivated favorable agro-industry, agro-industry profitability = 0 means that cultivated BEP and profitability <0 means unfavorable agro-industry.

Analysis of Business Efficiency

Business efficiency calculations used are Revenue Cost Ratio (R / C Ratio). R / C Ratio is the ratio between revenue and costs. Mathematically be written as follows:

$$\textbf{R / C ratio} = \frac{Total\ Penerimaan\ (TR)}{Total\ Biaya\ (TC)}$$

Where:
If the R / C> 1 then the cultivation of tomatoes profitable.
If the R / C <1 then the cultivation of tomatoes are not beneficial
If the R / C = 1 then the cultivation of tomatoes to break even, which is the effort gives the same amount of revenue by the number of issued.

III. RESULTS AND DISCUSSION

Cassava plants being developed in Indonesia consists of various types/varieties with their respective advantages. In this study conducted a survey of types, productivity, and cassava prices at the farm level. The survey was conducted in Cilebut, Dramaga, and Sukanagara District, Bogor Regency, West JavaProvince.

Cassava production in 2015 recorded in West Java as much as 23.44 million tonnes (BPS 2016) with the harvested area of about 1 million ha (BPS 2016), or average productivity - flat approximately 23.35 tons/ha. The productivity of cassava still far from the potential results of some yielding varieties of cassava, which can reach 40 - 60 tons/ha, even more. The survey results show that the improved varieties planted by farmers should be able to produce even higher. However, due to constraints of production costs, especially the cost of purchase of fertilizers that often plagued the farmers often do not perform fertilization, which resulted in lower production produced. Four provinces' most significant producer of cassava in Indonesia are Lampung, Central Java, East Java, and West Java, which accounts for about 76.37% of the total production of cassava in Indonesia. In West Java cassava price range Rp.1.200, - to Rp. 1.300, - Sedaangkan superior varieties obtained from the area of Subang and Garut is Manggu varieties and elephants. The survey results in Cilebut, Dramaga, and Sukanagara District, Bogor Regency, West Java Province average production of cassava varieties Manggu 52 tons per hectare, while the average production of cassava varieties of elephant 66 tons perhectare.

In this study, carried out the characterization of physical and chemical properties based on several criteria or attributes of the product that is the size, shape, color outer skin, the outer skin texture fineness, smoothness of the skin texture, color and smooth texture tuber flesh tubers. Results of analysis of physical propertiesshowed

similarities and differences in physical characteristics between cassava varieties Elephant and Manggu.

Technically, cassava cultivation technology can be broken down into seven (7) components necessary technology in the cultivation of cassava. The seventh component is soil preparation, variety selection, plant spacing, fertilization, pest control, irrigation, and harvesting. Land preparation is largely determined by the type of soil, soil physical properties (texture, structure, storability of water, soil depth), the chemical properties of the soil (pH, nutrient status, organic matter content, toxic compounds), and soil biological fertility. Land preparation can be done in the form of beds or ridges, while the selection of varieties, cassava will be cultivated enough options such as varieties or clones of cassava productivity high enough (improved varieties) are both own formal decree of the Minister or high-yielding variety islocal.

Table 1. Characterization of the Physical Properties Bulbs Varieties Elephants and Manggu

Physical Characteristics Bulbs	Cassava Varieties	
	Elephant	**Manggu**
Tuber size	Very large	moderate
shape Bulbs	elongated oval	oval round
Outer skin color Bulbs	Chocolate	slightly brown
Outer skin texture fineness	Rough	moderate
Subtle texture in the skin	somewhat Fine	somewhat smooth
Tuber flesh color	White, tasty	White, tasty
Subtle texture tuber	somewhat Fine	smooth
Production tonnes / ha	120	20
Age (months)	9-12	10

Varieties of great yielding varieties were found to have been tested by intensive cultivation technologies that will produce cassava with higher production than the original place of production. Results of analysis of farming cassava varieties that ditanama Manggu elephant and with a level of treatment that manure (10 tons/ha) without hormones and organic manure (10 tons/ha) with organic hormones.

Table 2. Average Production of Cassava Varieties of elephants and Manggu The Given Organic fertilizer and fertilizing Without Organic Hormones

Cassava varieties	Hormones + Organic Fertilizer	Without Hormones Organic Fertilizer
Manggu	86.00 tonnes/ha	59.50 tonnes/ha
Elephant	112.00 tonnes/ha	71.50 tonnes/ha

Table 3. Average Cost of Production of Cassava Cultivation Elephant and Manggu That Given Manure and Given Organic Hormone

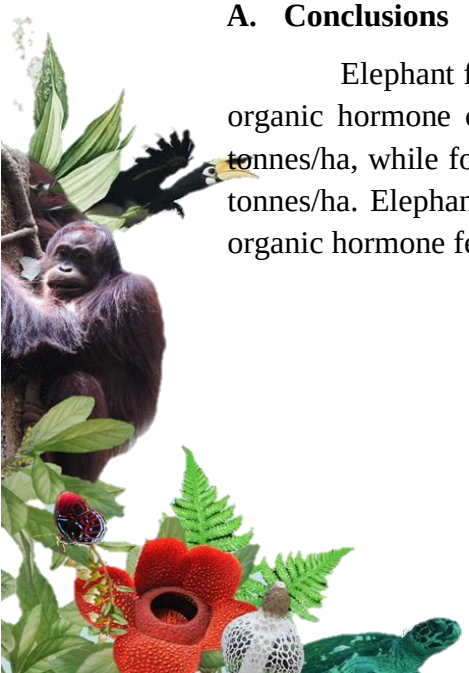
Commentary	Manggu	Elephant
Fixed cost		
Landlease	8,000,000	8,000,000
Landprocessing	600,000	600,000
Equipmentdepreciation	45,000	45,000
Variable costs		
Seeds	5,000,000	6,000,000
Labor	6.750.000	6.750.000
Manure10 tons	9,500,000	9,500,000
Organichormone	11,000,000	11,000,000
Pesticides	2,400,000	2,400,000
Transportation	2,500,000	2,500,000
Total costs (TC)	**35.15 million**	**36.15 million**
reception:	86.000 x 1200 = 103 200 000	112,000 x 1.200 = 134 400 000
Cassava Farmers Income Manggu and Elephant	**68.05 million**	**98.25 million**
R / C	**2,94**	**3.72**

The results of the analysis of the elephant farm cassava varieties and planting Manggu results using manure and organic hormone could increase the average production for a variety Manggu 26.50 tonnes/ha, while for the elephant varieties occur average escalation production of 40.50 tonnes/ha. This is because at the time of filling the bulbs, nutrients available in the soil sufficient for optimal tuber development. Elephant farm and Manggu cassava cultivation with fertilizing manure and organic hormone feasible with a value of R / C ratio of 2.94 and3.72.

IV. CONCLUSIONS AND RECOMMENDATION

A. Conclusions

Elephant farm cassava varieties and planting Manggu results using manure and organic hormone could increase the average production for a variety Manggu 26.50 tonnes/ha, while for the elephant varieties occur average escalation production of 40.50 tonnes/ha. Elephant farm and Manggu cassava cultivation with fertilizing manure and organic hormone feasible with a value of R / C ratio of 2.94 and 3.72.



B. Recommendation

We need to do further research for superior cassava varieties that are in different areas. Furthermore, the treatment needs to be done to some extent, the addition of organic hormone treatment in order to obtain the most efficient and effective.

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At this moment, I would like to thank Prof. Dr. Dra. Ernawati Sinaga, Ms, Apt. as Vice of Rector for Research, Community Service and Cooperation, Ir. Tri Waluyo, M.Agr, as Head of PPM Bureau UNAS, Mr. Ir. IGS Sukartono, M.Agr as the Dean of the Faculty of Agriculture of UNAS, and Head of Experimental Station Unas on moral and material support given to this research report can be resolved. Moreover, all parties that we can not mention one by one for the help so that research can work as expected.

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CULTIVATION TECHNIQUE AND HANDLING OFRED DRAGON FRUIT *(Hylocereus polyrhizus)* IN KAJARHARJO VILLAGE, KALIBARU DISTRICT, BANYUWANGI DISTRICT, EAST JAVA PROVINCE

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Abstract

The purpose of research to learn cultivation techniques and handling Pascapanen red dragon fruit in Kajarharjo Village, Kalibaru Sub-district, Banyuwangi Regency, East Java Province. The research was conducted in August 2018.. This research is a research survey. Data retrieval through observation and live interviews with dragon fruit Farmer. Data analysis is processed descriptively by describing in full the object of observation then tabulated and concluded. The results of the research known seedlings obtained from stem cuttings and planting done at the beginning of rainy season. The maintenance of dragon fruit crops include the binding of seedlings, irrigation, fertilization, pollination, weeding, trimming, addition of light and control of pests and diseases. The treatment of adding light is done by giving lights to the plants to increase production results. Dragon fruit harvesting process is done by cutting a branch with cuttings Guting. After the harvesting process is done sorting and grading. On the fruit the size of 350-370 grams (grade A), 250-350 grams (grade B), ≤ 250 grams (grade C). The selling price of dragon fruit out of season reaches Rp.18,000, - to Rp 20,000, -/kg, while the selling price during the harvest Rp2,500, - to Rp 5.000, -/kg.

Keyword : budidaya, buah naga, pascapanen

I. INTRODUCTION

Dragon fruit crop including cactus plants originating from the country that is Mexico, Central America and North America. Dragon Fruit Super Red is better known as a plant that is can from the Asian continent because it has been developed largely in some countries of the continent of Asia, especially like Vietnam and Thailand. Dragon Fruit is one of the horticultural commodities that has not been long known, Cultivated and undertaken in Indonesia. Dragon fruit plant which was originally known as an ornamental plant has long been known by the people of Taiwan, Vietnam, and Thailand, Dragon Fruit belongs to the family Cactacea with characteristic of having thorns on each section of trunk. Hylocereus undatus is a dragon fruit that is first known by the people of Indonesia (Kristanto,2010).

Dragon fruit is a popular fruit of late. This fruit began to be cultivated and marketed in Indonesia in the early years 2003. Dragon fruit includes tropical plants and can grow well in Indonesia. This led to the development of dragon fruit orchards in the Indonesian region. This development needs to be followed by cultivation technology and post-harvest that can improve the quality of dragon fruit in Indonesia in order to compete with dragon fruit originating from other tropical countries. (Andipati, 2006). Dragon fruit has many advantages and benefits. Dragon Fruit Excellence among others in terms of cultivation, dragon fruit is a plant that is quite easy to be cultivated and the climate in Indonesia support in the development of dragon fruit cultivation. In addition, dragon fruit has many benefits among others can lower cholesterol, balancing blood sugar, high fiber as a binder carcinogen substance causes cancer and smoothen the digestive process. (Cahyono,2009).

One of the areas that develop dragon fruit crops is Banyuwangi regency, therefore most people in Banyuwangi Regency planted dragon fruit in the yard, but the community has not done the maintenance of dragon fruit crops Well. Actually in conducting the technique of cultivation of dragon fruit well can be an additional source of income for the community Banyuwangi, although the plant is only planted in the yard. Djamila et al. (2010) suggests that the stage of the cultivation of dragon fruit starts from the nursery, the preparation of climbing poles, planting, and maintenance of crops. The maintenance of dragon fruit crops include irrigation, crop pruning, fertilization and pest control.

Banyuwangi community also has its own uniqueness to increase the productivity of dragon fruit. They use the help of light rays at night. It is a regional innovation for the Dragon Fruit Farmers Banyuwangi. In the development of the fruit flower of the Mexican origin requires sunlight for 12 hours, while the sun in a day is only able to give its rays about 9 to 10 hours. From this, Banyuwangi people use lamp light assistance, to improve the development of interest. This indicates that the dragon fruit is a plant that is sensitive to the addition of the radiation treatment, as presented by Luder and McMahon (2006) who suspect that Hylocereus spp, is a long-day plant that is sensitive to Addition of light.

Based on the background above, the authors are interested in reviewing the cultivation techniques and handling of post-harvest dragon fruit and problems in the village Kajarharjo as a research object titled "Cultivation Techniques and handling Pascapanen Buah Red Dragon (Hylocereus Polyrhizus) in Kajarharjo village, Kalibaru District, Banyuwangi Regency, East Java Province".

II. RESEARCH METHODS

Study area

This research was conducted in Kajarharjo Village, Kalibaru Sub District, Banyuwangi Regency, East Java. Research was conducted on August 2018.

Material reasearch

This research is a surver research so that in the crawl data use questionnaires as a guide for interviews in the field. The tools used in this study are notebooks, stationery, street boards, as well as mobile phones for documentation and recorder interviews.

Procedures

This research is a survey research. Primary data retrieval is done through observation and live interviews with dragon fruit farmers as respondents, the interview process is done using a prepared questionnaire. The population of the Dragon fruit farmer in Kajarharjo village is 6 people, which is then made a sample in this study. Secondary Data in the form of village Monography is obtained directly from the Kajarharjo Village office, related literature obtained from the journal. The data obtained from the respondent is then done by the data analysis and processed in a descriptive, by describing the complete observation object and then concluded.

Data Analysis

The data obtained from the respondent is being abulated, and then performed a descriptive analysis of data by describing the complete observation and inferred objects.

III. RESULTS AND DISCUSSION

Dragon Fruit Farmer Overview

Characteristics of the respondents of the research results in Kajarharjo Village, based on the age, level of education, and land area as shown in table 1:

Table 1. Characteristics of respondents

No.	Name	Age (Year)	Tingkat Pendidikan	Spacious Land (ha)
1	Setio Wibowo	63	S1	3,5
2	Munawar	33	SMA	0,035
3	Muklas	44	SMP	0,3
4	Nur Kholis	43	SMA	0,3
5	Jumari	38	SMP	0,05
6	Hasan	39	SMA	0,5

Based on the table data above, the average of the dragon fruit farmer respondents have a productive age of 43 years. Judging by the farmer's education level, 50% of respondents had high school education. In the table above also seen cultivation of dragon fruit is in demand by the population with a relatively high level of education ranging from JUNIOR to bachelor. The respondents chose to cultivate dragon fruit because they pay attention to the dragon fruit market which is quite promising, while the land that belongs to the dragon fruit farmers is largely private property with an average land area of 0.78ha.

Cultivation Tehnique

Banyuwangi is central to the cultivation of dragon fruit, the type cultivated by farmers is the fruit of the Red Dragon. Dragon Fruit is now a new primadona for farmers in the area Banyuwangi. In the dry land that was difficult to grow rice, now easily planted dragon fruit. Along the way, dragon fruit is seen by anyone who passes because almost all the yards of residents in the area of Banyuwangi, such as the District Kalibaru planted dragon fruit. No wonder when the harvest, the streets of the area are crowded by the then pick-up of dragon fruit carriers. In the dry land that was difficult to grow rice, now easily planted dragon fruit. Now, dragon fruit land is growing. The farmer in Kajarharjo village started to cultivate dragon fruit about 5 years ago, and to date continues toevolve.

Kajarharjo Village is a region located in the high altitude of Mount Raung in the mountainous region and the pekeding area with a height of approximately 428 m above, with a daily average temperature of 20-300C and rainfall ranging from 1372.2 mm/year in 5 years Finally, a relatively high rainfall support can increase agricultural productivity in Kajarharjo village.

People who are in the livelihood as farmers in Kajarharjo village are only a small part of their main job as dragon fruit farmers. In Kajarharjo village, there are dragon fruit in the yard, but only as an ornamental plant and the treatment is not maximal. Farmers in the village mostly choose to plant the Red dragon fruit type, with the reason the cultivation of this type is easier and faster to produce than other types, examples of dragon Fruit Garden found in Kajarharjo village can be seen in Figure 1.

Figure 1. Dragon Fruit Garden

The following is the stage in the cultivation of dragon fruit plants done by farmers in Kajarharjo village:

1. Seeding

Farmers in Kajarharjo village do not make a multiplication of the dragon fruit Plants generically (seed), because it is difficult to obtain it and it takes a relatively long time until the seeds are ready to plant. This makes the farmers choose vegetative reproduction (cuttings) of the trunk. Farmers choose the multiplication through cuttings because it is easier to obtain and plant growth is faster than the multiplication through the seeds. Prospective seeds that will be distek should be taken from a healthy branch, not too old and young is characterized by branches that are dark green and unheated and cultivated to choose branches that have been fruitful, because the growth is faster and Produce maximum production. Prospective seeds are cut using clean cuttings scissors, the average of the farmers use cuttings with a length of 50 cm. Prospective seedlings are mobilated in the shade where the sap dries for approximately 1 week, then directly planted to the land Without through the nursery using a polibag. If seedlings are directly planted into the land without the rubber drying process, the seedlings will be easily rotten and the success of the growth is very low. Examples of Dragon rod cuttings used as seedlings are presented in Figure 2, here.

Figure 2. Dragon Bar cuttings used as seedlings

2. Land Preperation

- **Climbing Pole Preparation**

Dragon fruit includes vines that require support/climbing to support the crop. The climbing pole used by farmers in Kajarharjo village is the life-climbing pole of the crop stem, because the trunk of the trees are believed to be stronger/sturdy farmer and able to last for many years. The network has a scientific name of Lannea Coromandelica and is included in the Anacardiaceae family which means one household with a mango tree. In Sulawesi, the network of crops is called Jawa Kayu and is widespread in Indonesia. The use of live climbing poles (tree trunks) is preferred by farmers, because itiseasiertogetandmorecost-effectivethanconcretepoles.FarmersinKajarharjo

village usually get the climbing pole by buying it on other farmers. The examples of live climbing pole stem crops can be seen in Figure 3.

Pole climbing is plugged into the ground with a depth of about 50 cm so that the pole stands firmly and strongly supports the crop. And the planting distance between the other pole climbing is 2x3 m. The climbing pole plant has an average height of 1.5 m with a trunk diameter of 10-15 CM. In addition to support the growth of dragon fruit crops, the climbing pole is also used by farmers as a shade in dragon fruit plants during the dry season.

Figure 3. Poles of Jaranan Plant (*Lannea coromandelica*)

- **Clearing Of Land**

The land that will be used for dragon fruit cultivation needs to be cleaned of weeds and trash around. The dragon fruit respondent farmers in Kajarharjo Village cleared the land in two ways, using a machine and manually. Weeds or small trees that appear on the ground are cut to the base of the trunk, weeds are cleaned by thin hoeing. The purpose of clearing this land is to avoid the struggle for nutrients with the seeds to be planted.

- **Land Management and Basic Fertilizer Application**

Land management aims to prepare the soil conditions as desired. The dragon fruit farmers in the village of Kajarharjo do the cultivation of land only around the pole and only accompanied by making drainage or ditches around theplant.

There are two types of basic fertilizers used by respondents of Kajarharjo Village dragon fruit, namely using compost at a dose of 5 g / climbing pole and those of farmers who use goat manure at a dose of 10 kg / climbing pole. Giving basic fertilizer, farmers do it by spreading or sowing around the climbing pole and hoeing back so that fertilizer is mixed evenly with the soil. Examples of basic fertilizers used by dragon fruit farmers can be seen in Figure4.

(a) Compost Fertilizer

(b) Pupuk kompos

3. Planting

Seedlings from cuttings that have been drained for about one week can be directly planted in previously cultivated land. Kajarharjo Village farmers plant dragon fruit at the beginning of the rainy season, because at the beginning of planting dragon fruit seeds need enough water to help plant growth. For one climbing pole, farmers usually plant 3-4 dragon fruit seedlings, the distance between the climbing pole and the seedlings is about 10 cm. Planting is done by making a planting hole as deep as 10 cm Then the seeds are placed in the excavation and piled with soil while compacted.

4. Maintenance

Once planted, dragon fruit plants need intensive care in order to grow and produce good. Some of the actions of the farmer's treatment in Kajarharjo village are as follows:

- **Seed Binder**

After all the seeds are planted the dragon fruit farmers in Kajarharjo Village do the binding of plant seeds. Stems of plant seeds are tied so that they stick to the climbing pole. Binding is not too tight to provide space for plant growth and so as not to hurt the stem. Binding is done on branches that grow in the main tendrils so that growth is regular upward until it reaches the end of the climbing pole. Each height increase of about 30 cm is done by binding the branch using a raffia rope. The ties can be removed if the roots that grow on the stem have grown and are strong and grow on the climbing pole. After the main tendrils of the dragon fruit plant reach the end of the pole and branch, then do the arrangement of the location of the tendrils that aim to direct the growth of plant growth to normal and regular shape. Examples of tied dragon fruit plant stems can be seen in Figure5.

Figure 5. Stem Planted Dragon Fruit Plant

- **Irrigation**

Dragon fruit plants don't need a lot of water. Because it is a type of cactus, dragon fruit plants can store their own water. Water is only needed in sufficient quantities during the dry season, irrigation is carried out by respondents of dragon fruit farmers in Kajarharjo Village, which is every 3 days. When the irrigation is done in the morning or evening.

Dragon fruit farmers in Kajarharjo Village use water from rivers around the land for irrigation. Farmers do traditional irrigation that is, using a 20 cm deep moat made around a row of plants. Water supply to the planting area is regulated per plot of land according to the condition of the land. Water is inserted from the trench that has a higher slope. The end of the trench is covered with soil so that the water stagnates in the trench. When the water has seeped evenly, the drainage of water is transferred to the ditch on the next plot of land. The way the end of the trench is opened until the remaining water from the trench is moved entirely to the other trenches and do so on until all the irrigated plots.

- **Fertilization**

Plant needs of nutrients can be obtained from the planting media. However, the nutrients contained in the growing media will be increasingly reduced because it has been used by plants for growth and development. Therefore, it is necessary to gradually replenishment of nutrients through fertilization. Fertilizer is an additional food for plants, with fertilizers that are tailored to the needs of plants then plants can grow fertile. The provision of good fertilizer is regular and periodic according to the growth phase.

Farmer of Dragon Fruit in Kajarharjo village to fertilizing plants organically and semi-organically. Farmers who cultivate plants organically only one respondent. The farmer used a goat manure mixed with ash and lime, an example of a mixture of manure, ash shell and lime used by farmers organic dragon fruit respondents can be seen in Figure 6. The frequency of fertilizer in dragon fruit plants is 20 days, at a dose of 1 kg/plant. The way of administration by making planting holes and closed back with soil.

Dragon fruit farmers who cultivate plants in a semi-organic using manure and chemical fertilizers. The manure used is goat manure at a dose of 10 kg/climbing pole and the given time is 3 months. While the chemical fertilizers used are ZA and NPK fertilizer. ZA Fertilizer administered one month after the introduction of manure and the allotted time of 3 months, at a dose of 20 g/climbing pole. For NPK fertilizer administered at the beginning of flowering, at a dose of 50 g/climbing pole. The way of manure is to sow it around the dragon fruit plant which is then closed back with the planting media.

Farmers who use organic fertilizer only in the cultivation of dragon fruit (organic farming) produce a higher production of 53 tons/ha compared to the use of inorganic fertilizer plus organic (semi-organic farming) that produces Average production of 35 tons/ha. It is suspected that organic fertilizer contains more complete nutrients than inorganic fertilizer as stated Sintia (2011) That one of the factors that affect the harvest yield is seen from the weight of the fruit then the fruit circumference is by giving Organic fertilizer because with fertilization done will improve the nutrients contained in the soil and can have and maintain soil fertility, soil fertility is influenced by organic materials contained in organicfertilizer.

Figure 6. Mixed Manure, Grey and Lime

- **Pollinating Plants**

Judging from the shape of the dragon fruit flower, it is difficult for this dragon fruit flower to pollinate itself naturally. Pistil and stamens are spaced too far so it is difficult to meet, therefore the average dragon fruit farmer pollinates manually, for example pollination of dragon fruit with human assistance can be seen in Figure 7. Dragon fruit flowers bloom at night, so the right time to pollinate is night. How to pollinate by removing pollen and rubbed on the pistil, when applying pollen to the pistil must be done carefully, not to damage the pistil stalk due to movement that is too hard and will cause the failure of pollination. Dragon fruit flowers are ready to be pollinated at the age of 15 days from the start of the appearance of flowers and 35 days after pollination is usually ready to beharvested.

Figure 7. Pollination With Human Assistance

- **Weeding**

Weeding is done by farmers depending on the height of weeds, this activity is usually done once a month with the intention that there is no struggle for nutrients with dragon fruit plants. The tool used depends on the height of weeds, the hoe is used for

weeds that are not too high, if the grass or small plants growing around the main plant already look dense or lush, weeding is done using a lawn mower.

- **Pruning**

The next dragon fruit treatment is pruning. Trimming is a series of activities to remove stems/branches, to form branching and form a productive branch whose goal is to obtain a growth balance so that productivity is also high. Therefore, the best trimming should be done as early as possible and periodically so that plant growth becomes more orderly. When pruning is not done, the branches will compete with each other and eventually become unproductive. In addition to the optimal growth of trimming can also stimulate flowering. The stem buds should also be trimmed, so that the fruit does not lack nutrients.

Farmers in Kajarharjo village trim parts of the dragon fruit Plant, the inner rod (Fig. 8), a branch that is not healthy or exposed to diseases, branches of unproductive plants (Fig. 9) and young shoots that grow at the tip of the trunk (Fig. 10). The inner branch does not get the sunlight in full then than it should be trimmed. This is due to the possibility of fruitfulness for the inner stem (unproductive furnace) is very low, different from the branch that is exposed to the full sunlight. If not done trimming on an unproductive branch it will reduce the nutrient allowance for the branch that is still productive, by pruning the branch is not productive then the existing nutrient allowances can be focused all into In the fruit for growth so it is not wasted in other parts on plants that are not needed. The pruning time of the farmer is once a year after the harvest season (April-May), for the trimming of the inner rod and branches that are too often fruitful. While trimming the young shoots at the tip of the stem is done at the beginning of flowering, because it can reduce nutrients forfertilization.


Figure8


Figure9


Figure10

- **Addition Of Light**

As with other fruits, dragon fruit is a seasonal fruit, which for Indonesia only blooms in October-March and the rest does not flower. This condition is a great opportunity for dragon fruit farmers to increase income, because the demand for dragon fruit increases and the selling price of dragon fruit outside the season is relatively more expensive, up to 2-3 times the normal price in the season.

The condition of the dragon fruit that can not flower outside the season resulted in dragon fruit farmers can not meet the demand for dragon fruit. The increasing demand and the relatively expensive price of dragon fruit are the main reasons for dragon fruit farmers to give treatment to dragon fruit. The treatment given by farmers in the Kajarharjo Banyuwangi Village area to dragon fruit outside the season (March-August) is to provide additional lighting at night for about 5 hours (18: 00-23: 00 WIB), but not all farmers use these treatments . The lamp color used by farmers is yellow with the trade name Shanhe, and the power used is 12 watts. Examples of lamp types can be seen in Appendix 5. Dragon fruit plants begin to be given extra light treatment outside the season when the plant produces its first production, which is 1 year after planting. An example of adding light can be seen in Figure 11.

Table 2. Effect of Light Treatment on Production

Effect	Production (Ton/ha)							
	1	2	3	4	5	6	Total	Average
Light	50	-	-	53	-	-	103	51,5
Not Light	-	28	33	-	30	34	125	31,25

Based on the table above it can be seen that the production of red dragon fruit in the village of Kajarharjo, without the treatment of adding light at night produces an average production of 31.25 tons / ha with a harvest amount of 10-11 times a year, while treatment with the addition of light at night days produce an average production of 51.5 tons / ha with a total harvest of 17-19 times a year. This shows that the lighting treatment given is proven to be able to stimulate dragon fruit to flower even out of season so as to increase production of dragon fruit. Chang (1968) stated that the addition of irradiation was carried out to regulate flowering time so that fruit production could be done out of season. Luders and McMahon (2006) suspect dragon fruit is a long day plant because of its sensitivity to light. The addition of irradiation has different effects onplants.

Figure 11. Adding the Light of the Dragon Fruit Plant at Night

- **Pest and Disease Control**

Every cultivation must be a problem-the obstacles experienced by farmers, for the constraints of pests and diseases. Dragon fruit crops include plants that have little enemies or pest disruptors. The types of pests that attack dragon fruit plants in the village of Kajarharjo are snail and bird. Snail attacked the buds – the young shoots the prospective dragon fruit branches into irregular disrepair because it was diawed. Snail response is done by removing all the snail around the plant manually. Controlling the pest attack can be by sanitation garden so that the presence of pests can be prevented. Garden cleanliness should be considered, especially the presence of weed should be removed. Weed in the garden is usually a nest of pests to breed examples of snail pests that are similar to the dragon fruit plants can be seen in Figure 12. While the bird pests usually attack the fruit that has been colored red and located on the top. This pest attack usually does not cause severe damage, so it can be ignored. Examples of fruits affected by bird attack can be seen in Figure13.

This type of disease that affects dragon fruit crop is soft rot on stems caused by Phytophthora sp. The decay is generally caused by excessive soil moisture. The stem soft foul attack symptoms are characterized by a watery tendrils and rotten brownish-yellow color. Soft stem foul disease can attack the tenures in the middle, base and tendrils tip. Soft Stem rotten disease management is done by cutting the stem with the disease completely, so that the spread of disease in healthy plants around it can be prevented. According to Septayanti 2013, the effective soft foul disease response to dragon fruit plants is by means of sanitary parts of plants that are infected. The tool for cutting should be cleaned with Clorox fluid (or Bayclin 2%) Before and after use. The cut has to be completely destroyed by fire. Examples of soft foul disease in dragon fruit plant stem can be seen in Figure 14.

Figure12

Figure13

Figure14

5. Harvest

The dragon fruit to be harvested must reach enough age. The Harvest age of dragon fruit usually 50 days counted when the flower appears. Farmers harvesting dragon fruit by way of manual. The harvesting tools used are fruit basket (Gambar15) and trim scissors.

Before harvesting the fruits there are several procedures to be considered, namely selection of ready-to-pick fruits and how to defloration. If one is not noticed it will affect the quality of the fruit. The time for harvesting first is when the plant is 1 year old after planting. The average number of dragon fruit production without the addition of light is 31.25 tons/ha in a year, while the average number of production using additional light 51.5 tons/ha in a year. The amount of production using a large meters light treatment because of the longer harvesting period and the addition of illumination is done to regulate the flowering time so that fruit production can be done out of season (Chang,1968).

The criteria of the harvested fruit that has the signs of fruit that the color of the skin has become dark red or glossy red, the crown of flowers has been shrinking or shrinking and the fruit tassels have turned into redness. According to Kristanto, 2003 harvesting criteria on dragon fruit plants is done on fruit that has the characteristics of glossy red skin color, tassels/scales change the color from green to reddish.

If you know the features of the fruit that has cooked harvest the next step is picking the fruit. The defloration of this fruit is no way or technique to avoid damaging the fruit and stems. The mistake in picking up the fruit will affect the selling price of the dragon fruit so that the farmer's profit can not be maximized. Picking up the fruit is done by cutting the fruit on its stem using trimscissors.

Picture 15. Dragon Fruit Collection Basket

6. Post-Harvest

Dragon Fruit Postharvest Handlers Include:

a. Sorting

Sorting dragon fruit is done after transporting fruit from the land using one wheelbarrow. Farmers do sorting dragon fruit by cleaning the dragon fruit from the remnants of dried flowers that are still sticking manually by hand and separating the fruit based on whether it is. Dragon fruit that is good or worth selling has the skin color of the fruit and tassels according to the characteristics of crop and smooth fruit skin. Dragon fruit that is not worth selling has a skin condition that is wound, bruises, perforated androtten.

b. Grading

After sorting the fruit is done, the harvest is classified based on the size and quality of the fruit. Dragon Fruit Pengkelasan based on grade A to C can be seen in table8.

Table 3. Grading Dragon Fruit

Weight (gram)	Grade	Quality
350-370	A	Good Quality
250-350	B	Good Quality
≤ 250	C	Low Quality

Dragon fruit Grade A and B are usually sold by farmers to brokers, skipper, to consumers, while the C grade is usually given to the residents around Kajarharjo village. Dragon Fruit Pengkelasan based on the table above with the proposed by Nugraha (2015) based on the size of dragon fruit can be distinguished in 3 classes of dragon fruit is super class (weight per piece > 700 gr), class A (weight per piece 400-700 gr), class B (weight per Fruit 300-400gr).

c. Packaging

A sorted dragon fruit can be packaged using a special tray plastic cardboard. Packaging using a plastic tray is usually done for shipping distances are not too far with a capacity of ± 30 kg fruit, while packaging the dragon fruit for the delivery distance is far enough to use cardboard that is given a partition-Sekat With the aim of limiting the fruit so it is not easily clash during delivery, because the fruit that collisions will be easily damaged or bruising. Dragon fruit will hold Save up to 2 weeks in room temperature.

d. Trasnportation

The tansportation used in the delivery of fruit is a motor and pickup car, depending on the number of fruits and mileage delivery. Example of transporting dragon fruit using pickup car can be seen in Figure 16,

Picture 16. Transportation of Dragon Fruit

7. Marketing

After being packaged, the marketing process is carried out. Usually at this stage, dragon fruit has both good and poor quality (grade A to C). After buying dragon fruit collectors (middlemen) new marketed to buyers. Second, farmers directly market to buyers around the dragon fruit field or around KalibaruDistrict.

Farmer respondents generally market dragon fruit to big cities (Jakarta, Bandung, Medan, Bogor, Lombok) or around Banyuwangi Regency. Dragon fruit when harvesting has an average price of Rp. 2,500-5,000 / kg and when it is outside of the harvest season it has an average price of Rp. 18,000-20,000 / kg.

IV. CONCLUSIONS ANDRECOMMENDATION

Conclusions

Based on the results and discussion above, it can be concluded that dragon fruit cultivation in Kajarharjo Village is initiated from crop breeding done by vegetative or branch cuttings. Treatment by farmers usually involves the binding of branches, watering, fertilization, pollination, weeding, trimming, pest and disease control and addition of light. The addition of light can increase the harvest period from dragon fruit up to 17-19 times a year, with the production reaching 53 tons/ha. Fertilization done using organic fertilizer and fertilizer NPK and ZA. Trimming forms a productive branch is usually done around April to May. Pests that usually attack dragon fruit crops, snail and birds, while the disease is rotten stem. Post-harvest handling by farmers is the collection of fruit, sorting and the library of fruit.

Recommendation

There needs to be coaching to the community about dragon fruit crops, kind, care, origin or benefits, with the expectation of more and more people who cultivate dragon fruit crops in the village Kajarharjo, not only used as a plant Without treatment.

Hopefully in the cultivation of dragon fruit more and more farmers who use the treatment of addition of light, because the dragon fruit can be fruitful outside the season so it can increase the production of dragon fruit.

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THE EFFECT OF STARFRUIT JUICE (*Averrhoa bilimbi L.*) ON TOTAL CHOLESTROL IN MALE WHITE RAT (*Rattus norvergicus*) INDUCED BY QUAIL EGG YOLK

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Abstract

Hypercholesterolemia is a condition when the level of cholesterol in blood goes over the normal limit. Quail egg yolk contains a high level of fat that causes the cholesterol rate in blood to rise. Vitamin C has the benefit of helping the process of bile salt forming in heightening the levels of cholesterol excretion, hence lowering the total rate of cholesterol in blood by avoiding lipid peroxidation. The purpose of this study is to discover the impact of giving bilimbi juice (Averrhoa bilimbi L) in obstructing the rise of total cholesterol level in male white rat (*Rattus norvergicus*) sprague dawley strain induced with quail egg yolks. This research is an experimental research using 5 stages of treatment, which are, negative control (K- without yolk induction), positive control (K+ induced with quail yolk 2 mL/ 200 gr BW), treatment (T1 induced with quail yolk 2 mL/ 200 gr and given bilimbi juice 0,48 mg/200 gr BW), treatment (T2 induced with quail yolk 2 mL/ 200 gr and given bilimbi juice 0,95 mg/200 gr BW), treatment (T3 induced with quail yolk 2 mL/ 200 gr and given bilimbi juice 1,42 mg/200gr BW). The checking of cholesterol levels in the rat utilizes the use of COBAS C-111 Analyzer. Data analysis uses the One Way Anova test with SPSS 24 program. The result of this study shows that there is a significant difference ($p<0,05$). The dosage of 0,48 mg/200gr BW of bilimbi juice (T1) is the most effective dose in preventing the rise of total cholesterol level in male white rat serum induced with 2mL/200 gr quail yolk.

Keywords : starfruit, quail egg yolks, total cholesterol, vitamin c

I. INTRODUCTION

Quail egg is a source of animal protein that is relatively cheap compared to other animal protein sources, such as chicken egg, meat, and mutton. Quail eggs have better nutritional content than fresh cow milk, seen from calorie, protein, fat, phosphor, iron, vitamin A, B, and B12 content. (Yunita et al,2014)

The nutritional content of quail eggs is also not at all below the protein found in chicken and duck eggs. The protein in quail eggs are up to 13,1% higher than that in chicken eggs with 12,7% protein. Quail eggs also have a lot of fat (Wuryadi, 2013). On the other hand, even though the nutritional content of quail eggs is considerably complete,withitsprotein,fat,vitamins,andmineral,butthecholesterollevelinthem

are also high, with the rate of 3600 mg/100 gr, whereas in the yolk of chicken eggs, the cholesterol level is only at 1275 mg/100 g. (Suripta, 2016).

Pharmacological investigations have shown that bilimbi contains lipid-reducing matter. Traditionally, bilimbi has been used as fresh juice, stew, infusion, or dry powder for wound healing, antidiabetic, antihipertension, and antihyperlipidemic (Alhassan, 2016).

The bilimbi fruits contain Vitamin C, riboflavin, thiamine, niacin, flavonoids, saponins, oxalic acid, and potassium oxalate. The pharmacological effects of bilimbi include increasing the excretion of the bile, anti inflammation, laxative urine, facial moisturizers, analgesics, and can reduce cholesterol levels (Wijayakusuma, 2008).

Vitamin C (ascorbic acid) as antioxidant that contained in it has the tendency to lower the risk of atherosclerosis by detaining cholesterol metabolism in the secondary atherosclerosis lesion to prevent cholesterol oxidation in athersclerotic lesions. Another function of vitamin C is to help hydroxylation reaction in the formation of bile salts to increase cholesterol excretion and hence lower the cholesterol level in blood, to prevent lipid peroxidation, reduce oxidative stress, and increase endotel function through nitric oxide production (Matondang, 2017).

A study done by Masruhen, "The Impact of Giving Bilimbi Infusion to Rat Blood Cholesterol Levels" shows that the administration of bilimbi infusion causes a meaningful decrease in blood cholesterol levels in male white rat induced with chicken egg yolk. However, a study concerning the effect of bilimbi juice to the decreasing of blood cholesterol level in rat induced with quail eggs is yet to exist. The problem in this research is that the effect of bilimbi juice as antihypercholesterol to the cholesterol level in male white rat is quail egg yolk is not yet known. As for the purpose of this research is to know the impact of bilimbi juice to the total cholesterol level in male white rat induced with quail eggyolk.

Based on a study about the impact of quail egg yolk induction on the total cholesterol level of male white rat, a hypothesis can be formulated as follows:

1. The induction of quail egg yolk in male white rat will cause a rise in the cholesterol level of male white rat.
2. Administrating bilimbi juice to male white rat will obstruct the increase of total cholesterol level in normalcondition.

II. RESEARCH METHODS

A. Studyarea

This research is a group research conducted for two months, fromDecember 2018 to January 2019 at the Zoology Laboratory, Faculty of Biology, National University of Jakarta and for the examination of cholesterol levels conducted at the Jakarta Regional HealthLaboratory.

B. Material research

The materials used in this study were 30 male white rats (*Rattus norvegicus*) Sprague Dawley strain, the experiment cage, treatment cage, animal food and drink, measuring cup, measuring pipette, measuring flask, digital scales, (ACIS AD 300), gastric sonde, filter cloth, serum separator tube, disposable syringe / 1cc and 3cc syringes, pins, mask, handscoon, washcloths, black marker, and surgical scalpel blades for surgery. Explanation of materials, specifications of tools used and questionnaire used in the study.

C. Procedures

1. Quail egg yolk preparation procedure

Quail egg yolk is separated from the egg whites, and then whipped untul it's well-blended. The administration of the yolk to the rat is by inducing it with a gastric pipe as much as 2 mL/rat done every morning for 28 days except in negative-control rat that are not induced with quail egg yolk. Pisahkan dengan bagian putih telurnya, kemudian kuning telur putuh yang didapat dikocok hingga rata.

2. Blimbi making production procedure

Blimbi juice is made by measuring fresh blimbi as much as 100 grams, afterward blended with a blender until it reaches a soft texture, and the filtered out into a beaker glas. This blimbi juice is administered every afternoon, 8 hours after quail egg yolk induction to male white rat, for 28days.

3. Blimbi juicedosage

There are 30 miligrams of vitamin C in 100 grams of blimbi. The dosage for an adult human with an average weight of 90 kg is 90-100 mg per day (Car and Frei, 1999). The vitamin C necessity for a rat with a weight of 900 grams in a day is 100 mg. 70 kg x 200 gram = 0,286 mg of vitamin C. A 200-gram rat would need 0,286 mg/30 x 100 gram = 0,95 gram vitamin C.

4. **Male white rattreatment**

a. Preparing rat cage filled with considerable bran and changed every 3 days, preparing food and drink in the cage.

b. Rat are given a stage of adaptation, in this stage they are separated into 5 different treatments (each consisting of 6 rat) and put into cages. Rat are left alive for a week without treatment. Cages are always cleaned and rat are fed with pellets twice a day and their waterrefilled.

c. After a week the randomised rat are given treatments, with the treatment for each group asfollows:

- K - : Rat with negative control, fed with standard pellets with tap water ad libitum and given 2 mL of aquades induced with a gastric pipe in the morning for 28days.
- K+ : Rat as positive control, fed with standard pellets and quail egg yolk by way of induction with a gastric pipe as much as 2 mL in the morning for 28days.
- T1 : Rat are given standard pellets and 2 mL of quail egg yolk by induction with a gastric pipe in the morning, then followed by the administration of bilimbi juice, as much as 0,48 mL/200gBW induced using a gastric pipe in the afternoon for 28days.
- T2 : Rat are fed standard pellets and induced with 2 mL of quail egg yolk using a gastric pipe in the morning, proceeded with administrating to them 0,95 mL/200gBW bilimbi juice induced with a gastric pipe in the afternoon for 28days.
- T3 : Rat are fed standard pellets and 2 mL of quail egg yolk in the morning, induced with a gastric pipe, and then followed by inducing 1,42 mL/200gBW of bilimbi juice with a gastric pipe in the afternoon for 28days.

d. The gap between the administration of quail egg yolk and bilimbi juice in male white rat is approximately 8 hours. In the day after the 28th day, the rat are dissected and their blood is taken as sample to go through cholesterol level assessment.

5. **Blood withdrawal via heartprocedure**

In taking sample from the heart, the first thing to do is to anesthetize the rat using diethyl ether until they are unconscious and supine. After that, After that, the palpation of the heart's position is carried out, after the position of the heart is found then the heart is pricked with a syringe, and this must be done quickly and carefully, if the prick is not done correctly or pierces to the lower part of the heart, blood in the heart may spread out of theorgan.

6. Cholesterol level examination procedure

The blood sample previously withdrawn is centrifuged with 350 rpm speed for 15 minutes to separate the serum from the blood cells, and after that the serum is separated and examined using cobas C511 then an examination is chosen based on the examination parameter that is to be checked. Explanations of procedures/ methods of data collections/ sampling techniques / research procedures.

D. DataAnalysis

This research used is one-way Anova analysis and Least Significant Different (LSD) as a follow-up test which supported by SPSS 24 program.

III. RESULTS AND DISCUSSION

Based on the cholesterol level examination result of the male white rat serum induced with quail egg yolk and bilimbi juice (Averrhoa blimbii L) shown in Table 1 and Image 1, below is average yield data and standard deviation examination of serum cholesterol levels in male white rat (*Rattus novergicus*).

Tabel 1. Serum cholesterol level in male white rat

Treatment level	Cholesterol level (mg/dL)	
	Yield	Standard deviation
Control -	50,80	10,281
Control +	63,80	4,324
T 1 (low dosage)	43,24	3,033
T 2 (moderate dosage)	51,17	5,636
T 3 (high dosage)	49,20	5,762

Table 1 shows that treatment level K - has a cholesterol level yield of (50,80 ± 10,281) smaller than K + and T2, yet greater than T1 and T3. Treatment level K + has a total cholesterol level yield and standard deviation variation of (63,80 ± 4,324), greatest compared to K -, T1, T2, and T3. Low dosage treatment level (T1) has a yield of (43,20 ± 3,033) cholesterol level, lowest compared to K -, K +, T2, and T3. Moderate dosage treatment level (T2) has a yield of (51,17 ± 5,636) cholesterol level, lower than K +, yet greater compared to K -, T1, and T2. High dosage treatment level (T3) has a yield of (49,20 ± 5,762) cholesterol level, smaller than that of K -, K +, and T2, yet greater than T1.

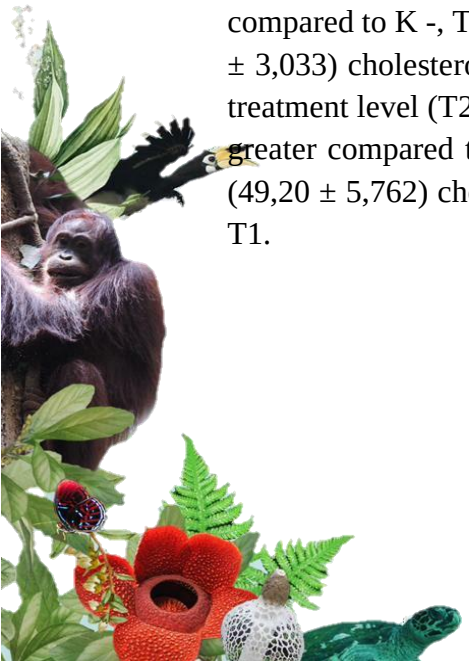
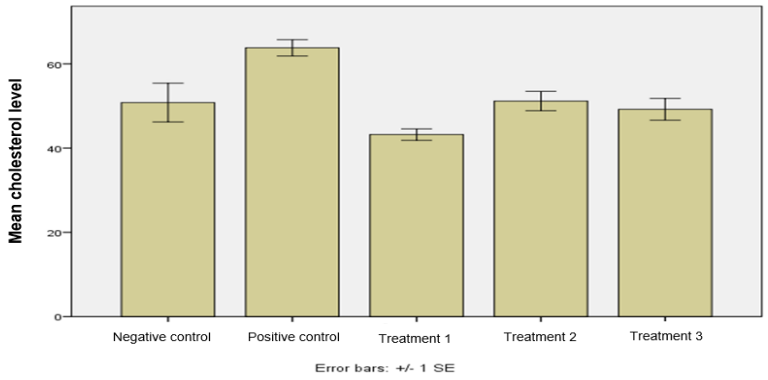


Image 1. Bar chart of serum cholesterol levels in male white rat



Based on image 1, it is shown that treatment level T1 has the lowest cholesterol level compared to the other four treatment levels (K -, K +, T2, and T3). Treatment level T2 has the highest level of cholesterol compared to three other treatment levels (K -, T1, and T3). Whereas for treatment level P3, the cholesterol level is higher than P1 yet lower than three other treatment levels (K -, K +, and T2). Following after, a homogeneity test is done for the male white rat cholesterol serum and the results show a significant 0,169 ($p > 0.05$), which means that the variation of scattered data is homogenous. (table2).

Tabel 2. Test of Homogeneity of variances cholesterol level

Levene Statistic	df1	df2	Sig.
1.788	4	21	.169

After the results of the homogeneity test has been obtained, following after that is a *One way Anova* statistics test (table 3) and it shows the significant result of 0,001 ($p < 0,01$), which means Ho is denied and Ha is accepted that the yield for all treatment levels are real or significant, thus the result of male white rats serum cholesterol level proceeds to further testing by *Least Significant Difference (LSD)* of 5%. In the LSD test as shown in table 4, obtained tangibly different or significant results ($p <0.01$) including the level of K - treatment with K + (0.004).

Tabel 3. Anova test of cholesterol level

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1130.121	4	282.530	7.183	.001
Within Groups	826.033	21	39.335		
Total	1956. 154	25			

Based on the result of the cholesterol level measurement in each of the treatment levels, the negative and positive control in the LSD test show evident difference (table 4). The group with 2 mL quail egg yolk and star fruit juice with various treatments (K -, K +, T1, T2, and T3) already can prevent the increase of cholesterol level in male white mice.

This is caused by antioxidant, that is the vitamin C, contained in star fruit that has a role in cholesterol metabolism, which is to escalate the rate of cholesterol being removed in the form of bile acids, increasing the level of HDL, and lowering the reabsorbing of bile acids and their conversion into cholesterol, other than that also plays a role in collagen formation, so as to prevent atherosclerosis (Meirindasari et al, 2013).

Tabel 4. Output post hoc LSD

Multiple Comparisons

Dependent Variable: Cholesterol level

LSD

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Negative Control	Positive Control	-13.000*	3.967	.004	-21.25	-4.75
	Treatment 1	7.600	3.967	.069	-.65	15.85
	Treatment 2	-.367	3.798	.924	-8.26	7.53
	Treatment 3	1.600	3.967	.691	-6.65	9.85
Positive Control	Negative Control	13.000*	3.967	.004	4.75	21.25
	Treatment 1	20.600*	3.967	.000	12.35	28.85
	Treatment 2	12.633*	3.798	.003	4.74	20.53
	Treatment 3	14.600*	3.967	.001	6.35	22.85
Treatment 1	Negative Control	-7.600	3.967	.089	-15.85	.65
	Positive Control	-20.600*	3.967	.000	-28.85	-12.35
	Treatment 2	-7.967*	3.798	.048	-15.86	-.07
	Treatment 3	-6.000	3.967	.145	-14.25	2.25
Treatment 2	Negative Control	.367	3.798	.924	-7.53	8.26
	Positive Control	-12.633*	3.798	.003	-20.53	-4.74
	Treatment 1	7.967*	3.798	.048	.07	15.86
	Treatment 3	1.967	3.798	.610	-5.93	9.86
Treatment 3	Negative Control	-1.600	3.967	.691	-9.85	6.65
	Positive Control	-14.600*	3.967	.001	-22.85	-6.35
	Treatment 1	6.000	3.967	.145	-2.25	14.25
	Treatment 2	-1.967	3.798	.610	-9.86	5.93

*. The mean difference is significant at the 0.05 level.

As explained by Wijayakusuma in his book (Ramuan Herbal Penurun Kolesterol, 2008 - Cholesterol Lowering Herbs), bilimbis contain vitamin C, riboflavin, thiamin, niacin, flavonoids, saponins, oxalic acid, and potassium oxalate. The pharmacological effect of bilimbi includes increase the expenditure of bile, anti-

inflammatory, laxative urine, facial moisturizers, analgesics, and can reduce cholesterol levels. Saponin in bilimbis is also believed to be beneficial in controlling the cholesterol levels in the body. Saponin can decrease blood cholesterol level by forming complex bonds that do not dissolve with cholesterol from food in the intestine, so that the cholesterol is not absorbed. Saponin can combine with bile and cholesterol from food to form ratlles which also cannot be absorbed by the intestine (Hartini, 2011).

Whereas niacin helps the metabolism in creating energy and plays a role in fat metabolism to lower the level of bad cholesterol, or so-called LDL (Low Density Lipoprotein), and triglycerides by inhibiting tissue fat overhaul, reduces the uptake of free fatty acids by the liver and increases cholesterol expenditure by the liver, thus the plasma cholesterol level decreases (Hartini, 2011). Niacin can also be found in bilimbis.

IV. CONCLUSIONS AND RECOMMENDATION

A. Conclusions

Based on the results of research that has been done it can be concluded that:

1. Induction of quail yolk increases total cholesterollevels.
2. Provision of starfruit juice with a dose of 0.48 mg / 200gr BW (T1) can prevent or inhibit the increase in serum total cholesterol levels in male white rats induced by quail egg yolks 2mL / 200gr.

B. Recomendation

1. Further research is needed in order to find out what compounds are contained in bilimbi juice more precisely to prevent or inhibit the increase in cholesterol levels.
2. Further research needs to be done on histopathological examination of endothelial lining of rat blood vessels induced by quailyolk.

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ADDITIONAL BIO-ORGANIC FERTILIZER Beyonic StarT-mik @ lob. ON THE GROWTH AND YIELD OF CHILLY (*Capsicum annum* L) AND CAYENNE PEPPER (*Capsicum frutescens* L)

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Abstract

This study aims to analyze the growth of chili and cayenne pepper with the addition of Beyonic StarT-mik @ lob (POH) organic fertilizer. This research was conducted April 2017-June 2018 at the Green House Faculty of Agriculture, UNAS Jakarta. The experimental design was a Factorial Complete Randomized Design, the first factor being POH dose (0; 10; 20; 30; and 40 ppm) and the second factor being the frequency of POH addition (1 and 2 times a week). Each treatment consisted of 3 replications. The observed variables were: plant height, stem diameter, fruit length, fruit diameter, fruit weight per plant, number and weight of fruit. The data obtained were analyzed by ANOVA test using the SPSS program, and further tests (DMRT) at 5% significance level. The results of the study of chili and cayenne pepper showed that, the best frequency of fertilizer application was once a week. The chili research results, at the highest dose of 40 ppm POH for plant height, stem diameter, fruit diameter, weight per fruit, number and weight of fruit while at a dose of 30 ppm the longest fruit length. The results of the study of cayenne pepper showed that, at a dose of 30 ppm POH plant height, the number of fruits, the highest fruit weight per fruit while at a dose of 40 ppm, stem diameter, fruit diameter, fruit length, and highest fruit weight.

Keywords : Beyonic StarT-mic, fruit weight, frequency, bio-organic fertilizer

I. INTRODUCTION

Chili (*Capsicum annuum* L.) is one of the important types of vegetable plants in Indonesia because it has high economic value. Red chili is consumed in fresh or processed form to meet household needs, namely as a food supplement or known as a mixture of traditional medicines (Ganefianti and Wiyanti, 1997). However, along with the current human and technological needs, red chili is also used as an industrial raw material for medicines, cosmetics, dyes, and other uses (Maflahah,2010).

Cayenne pepper (*Capsicum frutescens* L.) is one of the important vegetable plants in Indonesia because it has a high economic value (Cahyono, 2003). Cayenne is used as a cooking spice and medicinal ingredients (Heyne, 1987) can also be consumed in fresh and processed form. In general, cayenne pepper contains nutrients including fat, protein, sugar, calcium, phosphorus, iron, vitamins A, B1, B2, C and various alkaloids such as capsaicin, oleoresin, flavonoids and essential oils. This content is widely used as

a spice in cooking, traditional medicinal herbs, food industry and ungags feed (Rukmana, 2002).

The need for chili is high, while national production is unable to meet the demand which is always increasing from year to year. According to BPS (2016), in 2015 the chili harvest area in Indonesia was 120,847 ha with a production of 1,045,182 tons and a production of 8,649 tons / ha. More every year there is an increase in productivity, the price of chili continues to increase, because of the rapidly increasing needs.

The increase in chili prices lately is very high and fluctuating, is a challenge in agriculture. Raising the price of this chili depends on limited demand. Limited Kabai. This is a serious challenge in chili cultivation, which must increase productivity even higher.

One that increases progress is a decrease in soil fertility can be overcome by applying fertilizer. Provision of inorganic fertilizers continuously made hard soil. Therefore it is necessary to help organic fertilizer. This can be overcome by the use of organic organic fertilizer (POH).

Bio-organic fertilizer or organic organic fertilizer (POH) helps in increasing macro and micro contribution, nutrient efficiency, increasing system efficiency, increasing efficiency, increasing and increasing yields. For the application of organic biofertilizers, the use of interesting inoculants for now is N (Nitrogen) and microbial fixing microbes to increase the availability of P (phosphate) in the soil. Engelstad (1997) in Moelyohadi *et al*., (2013) states that the use of organic matter into the soil can play a role in improving the physical, chemical, and biological soil properties. The physical and chemical properties of organic matter which are attached to the soil and interact with microorganisms can build a fertile environment. Conditioned soil environment because the intake of organic material will support the availability and ease of transportation of nutrients from the soil to plants. Mineralized nutrients can be bound by soil containing organic matter (humus) and cause nutrients not easily carried by waterflow.

Organic fertilizers do not cause pollution to soil and air that are suitable for use in plant cultivation for long-term use (Shao et al. 2012) in (Juhaeti et al. 2013).

Biofertilizer organic used in this research is Beyonic StarT-mik @ lob. Juhaeti et al. (2013) announced, Beyonic StarT-mik @ lob is an organic fertilizer developed by the Microbiology Division. LIPI Biology Research Center. This fertilizer contains various root microbes that have been tested as phosphate solvents, N-fixing, producing growth regulators (IAA, Cytokirun, Gibberellin) and are used as biocontrols. Microbial populations move between 10^{-6} - 10^{-7}. Application usage of 10-15 liters / ha, with a dosage of 25-30 cc mixed with 1 liter of air.

Biological organic fertilizers contain nutrient sources such as N, P, K, and othernutrients.Microbesaddedtoorganicbiofertilizerscanincreasenutrients,canalso

increase nutrient uptake (uptake) by plants so that fertilizer efficiency increases (Khudori, 2006). Application of organic organic fertilizers for inorganic fertilizers is done to protect the environment from inorganic fertilizers (El-Habbasha et al., 2007). The use of organic organic fertilizer (POH) not only stimulates plant growth, it is also able to improve soil structure, through improving soil physical, chemical and biological properties. Some research results from the LIPI POH application show that the fertilizer is suitable to be applied to increase vegetable production (Lingga and Marsono, 2006) in (Juhaeti *et al*., 2016).

The results of research by Akil et al., (2015) stated that biofertilizers can reduce the use of inorganic fertilizers by up to 50% and give higher yields than recommended fertilizers such as Beyonik, Agrifit, Bion-UP, Probio-New and Super Biost. Bio Padjar biofertilizers can reduce the use of urea and SP 36 fertilizers by 25%. Nuro *et al*., (2016), states that the application of Beyonic organic fertilizer influences changes in soil chemistry and production of ground water spinach. The best increase in nutrient content in soils is obtained in the treatment of compost made from litter and livestock manure. Increased production by 4.27% compared to control treatment. Overall organic fertilizer can improve soil chemical properties and become an alternative fertilizer towards organicfarming

NPK ½ dose combined with Startmik gives pretty good results. Fruit production tends to be quite high until the third harvest (on eggplants) and on the fourth harvest (on round eggplants), then decreases. The total number of fruits / plants produced is proportional to the NPK application combined with Commercial PO and more than the NPK combined with Megarhizo (Juhaeti and Lestari,2016).

This study aims to determine the increase in growth and production of chili (red and cayenne) by adding organic organic fertilizer at variousdoses.

II. RESEARCH METHODS

A. Area of Study

This research was conducted in September 2017-June 2018 at the Green House Faculty of Agriculture, Universitas Nasional of Bambu Kuning, Pasar Minggu, South Jakarta.

B. Material research

Materials used in this study were red chili, cayenne pepper, Beyonic StarT-mik @ lob organic fertilizer, furadan, basamid, insecticide, Ripcord, Prima Trubus, alcohol, label, marker, yarn, sandpaper, zinc, raffia rope, paint. The tools used in this study were cameras, scissors, solations, tweezers, scales, fat sheets, hoes, stationery, brushes.

C. Procedure

The experimental design used was a Factorial Complete Randomized Design (CRD), with 2 treatment factors. The first factor is the dose of organic fertilizer (D), D0 = control, D1 = 10 ppm, D2 = 20 ppm, D3 = 30 ppm, D4 = 40 ppm Beyonic StarT-mic @ lob per Liter organic fertilizer and the second factor is the frequency of administration fertilizer (F), F1 = fertilizer application once a week, F2 = fertilizer application every 2 weeks. Each treatment was repeated 3times.

Planting Media Preparation and 1: 1 ratio compost sterilization which has been sterilized was put into a polybag as much as 5 kg / polybag.

Nursery and Planting

The chilli seeds to be planted are prepared and soaked in a fungicide solution (1 g / L) for 10 minutes. The seeds are sown on a mixture of soil, sand and manure media (1: 1: 1. V / v). After the 4-5 leafy seedlings are ready to be transferred to a prepared polybag. Then given POH according to treatment.

Plant Maintenance

The activities of caring for plants that are carried out are watering, polluting, replanting, removal of water buds (deodorizing), supplementary fertilization, and controlling plant pests (OPT).

Harvest

Chili and cayenne pepper can be harvested for the first time at 4 months 2 weeks for the highlands. For the second harvest, it is conducted twice a week, after that the productive period of the harvest is done once in 2 days until the productive period of the chili runs out.

Observation Variabel

The variables observed in this study were: plant height (cm), stem diameter (cm), fruit length (cm), fruit diameter, weight per fruit, number of fruit and weight of fruit.

Data Analysis

The data obtained were analyzed by ANOVA test using the SPSS program. ANOVA test results were significantly different followed by Duncan test (DMRT) at 5% significancelevel.

III. RESULT AND DISCUSSION

This research was conducted at the Experimental Garden of the Faculty of Agriculture Universitas Nasional on Jalan Bambu Kuning, Kelurahan Jati Padang, Pasar Minggu, South Jakarta (26.2 m asl). Average rainfall of 13.9 mm / day, humidity of 81% with the intensity of solar radiation 52%. Temperatures range from 24.3 to 32.2 ° C.

The general condition of chili and cayenne pepper plants in the green house at the beginning of the transfer to polybags and 5 MST can be seen in Figure 1.

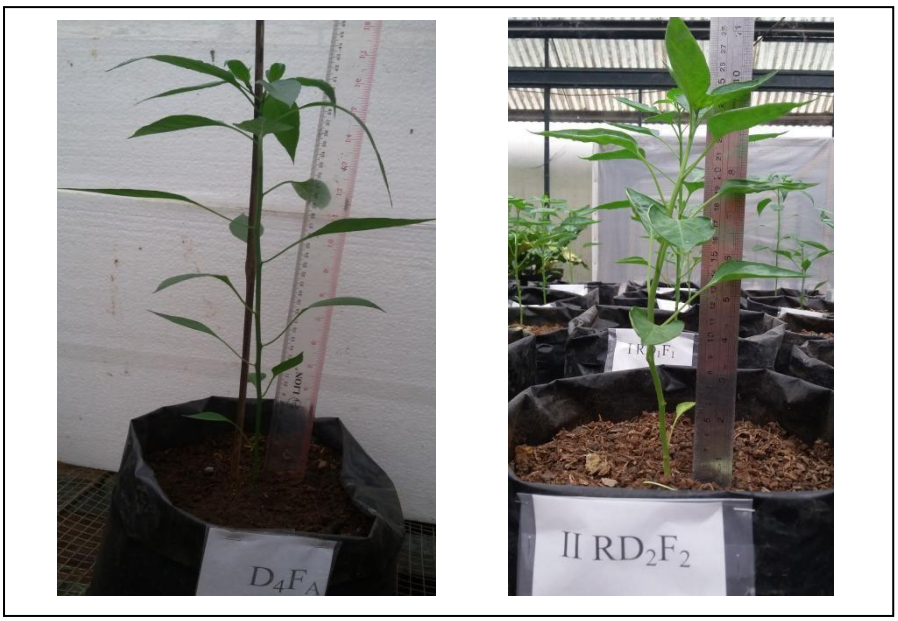


Figure 1. Early Chilli (left) and Cayenne Pepper (right) age of 5 MS

Vegetative growth

Plant height

The results of observations of the average height of plants chilli and cayenne pepper at 2,4,6 and 8 MST can be seen in Table 1. It is seen that the height of the plants at the highest treatment in the D4F1 treatment (115,867cm), followed by the D4F2 treatment (111,867cm) and treatment D3F1 (111,667cm). The highest height of cayenne pepper was in D3F1 treatment (94.17 cm), followed by D4F1 treatment (70.67 cm) and D1F1 treatment (50.00 cm).

Anova test results of interaction between the dose of organic fertilizer and the frequency of fertilizer application to plant height were not significantly different. Annova single treatment dose of organic fertilizer and the frequency was not significantly different from plant height, but the frequency of fertilizer application of cayenne pepper was significantly different at 8 MST.

Table 1.Effect of Interactions Organic Fertilizer Dose and Frequency on Chili and Cayenne pepper PlantHeight

Treatment	Plant Height(cm)							
	2 WAP		4 WAP		6 WAP		8 WAP	
	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P
D_0F_1	23,53	35,73	41,53	36,73	79,83	37,73	107,67	38,33
D_1F_1	25,40	40,73	48,40	43,23	75,83	45,73	109,33	46,15
D_2F_1	28,17	42,07	49,50	42,8	80,63	43,53	111,67	43,85
D_3F_1	28,33	50,87	51,00	54,92	81,00	58,97	111,67	61,9
D_4F_1	29,17	54,63	53,50	57,78	86,50	60,93	115,87	62,92
D_0F_2	20,80	32,73	41,23	33,38	75,70	34,03	93,97	34,68
D_1F_2	21,90	31,17	42,13	32,67	76,43	34,17	106,97	34,4
D_2F_2	24,17	39,37	43,37	40,44	77,17	41,5	107,33	41,82
D_3F_2	24,37	32,83	45,17	34,53	79,67	36,23	111,33	36,62
D_4F_2	26,97	52,47	47,97	52,99	83,5	53,5	111,87	54,09

Table 2 shows that Chili Plant Height the dose of organic fertilizer D_4 (40 ppm) is better than the other doses. Cayenne peppert plant height show that the dose of organic fertilizer D_3 (30 ppm) is better than the dose of 40 and 20 ppm. The higher the dose of Beyonic StarT-mik @ lob organic fertilizer, the higher the plants in the same element. This is in support with research by Juhaeti et al. (2013) which states that with a dosage of using 25-30 cc of organic fertilizer Beyonic StarT-mik @ lob mixed with 1 liter of water gives betterresults.

Table 2. Effects of Organic Fertilizer Doses on the Plant Height of Chili and Cayenne Pepper on 2,4,6,amd 8 WAP

Treatment	Plant Height (cm)							
	2 WAP		4 WAP		6 WAP		8 WAP	
	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P
D_0	22,17	34,16	41,38	35,06	77,77	35,88	100,82	36,51
D_1	23,65	35,95	45,27	37,95	76,13	39,95	108,15	40,28
D_2	26,17	40,72	46,43	41,62	78,90	42,52	109,51	42,84
D_3	26,35	41,85	48,083	44,725	80,333	47,60	111,51	49,26
D_4	28,07	53,55	50,73	55,39	85,00	57,22	113,87	58,51

Table 3 shows that the frequency of giving Beyonic StarT-mik @ lob organic fertilizer to chili and cayenne pepper plants once a week (F1) shows that the best plant height is at 8 MST. This is presumably because the nutrient content in the treatment is sufficient to provide fertilizer once a week compared to 1 times 2 weeks. This is

supported by the use of organic organic fertilizer (POH) proven not only to stimulate plant growth, but also able to improve soil structure, through improving physical, chemical, and biological soil properties. Some research results of the LIPI POH application show that the fertilizer is suitable to be applied to increase vegetable production (Lingga and Marsono, 2006) in (Juhaeti et al., 2016).

Results of variance analysis in frequency of aplication of organic fertilizer Beyonic StarT-mik @ lob were not significantly different, but the frequency of fertilizer application of cayenne pepper was significantly different at 8 MST.

Table 3. Effect of Frequency of Organic Fertilizer on Plant Height

Treatment	Plant Height(cm)							
	2 WAP		4 WAP		6 WAP		8 WAP	
	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P
F_1	26,92	44,81	48,787	47,09	80,76	49,38	111,25	50,63a
F_2	23,64	37,71	43,97	38,80	78,49	39,89	89,31	40,32b

Stem Diameter

The results of variance in the diameter of chili stems and cayenne peppers, both the interaction between the dose of Beyonic StarT-mik @ lob organic fertilizer and the frequency of administration as well as the single treatment of fertilizer doses and the frequency were not significantly different. The average observations of stem diameter of chili and cayenne pepper can be seen in Table 4. The diameter of chili stems in this study shows that at the age of 8 MST D_3F_1 treatment gave the best results of 0.503 cm, followed by D_4F_1 (0.5 cm) treatment and treatment D_2F_1 (0.43). The stem diameter of the chili plants treated D_3F_1 gave the best results of 0.64 cm, followed by the treatment of D_4F_1 (0.57 cm) and the treatment of D_1F_1 (0.55). Stem diameter is one of the parameters that determine plantgrowth.

Table 4. Effects of Organic Fertilizer Dose Interaction and Frequency of Aplication on Stem Diameter of Chilli and Cayenne Pepper Plants

Treatment	Stem diameter (cm)					
	4 WAP		6 WAP		8 WAP	
	Chilly	C.P	Chilly	C.P	Chilly	C.P
D_0F_1	0,263	0,290	0,290	0,370	0,407	0,420
D_1F_1	0,273	0,440	0,310	0,470	0,423	0,470
D_2F_1	0,270	0,360	0,297	0,420	0,427	0,450
D_3F_1	0,293	0,460	0,343	0,510	0,503	0,540
D_4F_1	0,290	0,410	0,347	0,470	0,500	0,510
D_0F_2	0,250	0,350	0,290	0,430	0,343	0,490
D_1F_2	0,270	0,290	0,290	0,310	0,393	0,310

D_2F_2	0,273	0,350	0,290	0,390	0,413	0,390
D_3F_2	0,270	0,330	0,290	0,350	0,410	0,350
D_4F_2	0,290	0,40	0,320	0,440	0,420	0,460

Table 5 shows that the Beyonic StarT-mic @ lob D4 40 ppm (0.46 cm) organic fertilizer dosage is the best dose and followed by the D3 dose of 30 ppm (0.457 cm) for the diameter of the chili plant. Likewise, the diameter of cayenne pepper at a dose of 40 ppm (0.55 cm) is the best dose and followed by a treatment with a dose of 30 ppm (0.51 cm). Increasing the dose of organic organic fertilizer is followed by an increase in stem diameter.

Table 5. Effect of Doses of Organic Fertilizers on the Stem Diameter of Chili ang Cayenne Pepper Plants

Treatment	**Stem diameter (cm)**					
	4 WAP		6 WAP		8 WAP	
	Chilly	C.P	Chilly	C.P	Chilly	C.P
D_0	0,26	0,32	0,29	0,40	0,38	0,46
D_1	0,27	0,37	0,30	0,39	0,41	0,42
D_2	0,27	0,36	0,29	0,41	0,42	0,42
D_3	0,28	0,40	0,32	0,43	0,46	0,45
D_4	0,29	0,41	0,33	0,46	0,46	0,49

Furthermore, the effect of the frequency of Beyonic StarT-mik @ lob organic fertilizer once a week gives the best results in chillies aged 8 MST, ie 0.45 cm and 0.48 cm in cayenne pepper (Table 6).

Table 6. Effect of Frequency of Organic Fertilizer on Stem Diameter of Chili Plant

Treatment	**Stem diameter (cm)**					
	4 WAP		6 WAP		8 WAP	
	Chilly	C.P	Chilly	C.P	Chilly	C.P
F1	0,28	0,39	0,32	0,45	0,45	0,48
F2	0,27	0,34	0,29	0,38	0,40	0,40

Production component

The results of observations of the average dose of Beyonic StarT-mik @ lob organic fertilizer and the frequency of administration of fruit length, fruit diameter, weight per fruit, number of fruit harvested, fruit weight can be seen in table 7. Fruit diameter, weight per fruit, number of fruit , the highest weight of chilli fruit at D_4F_1 treatment (40 ppm organic fertilizer dose and frequency of administration every week)

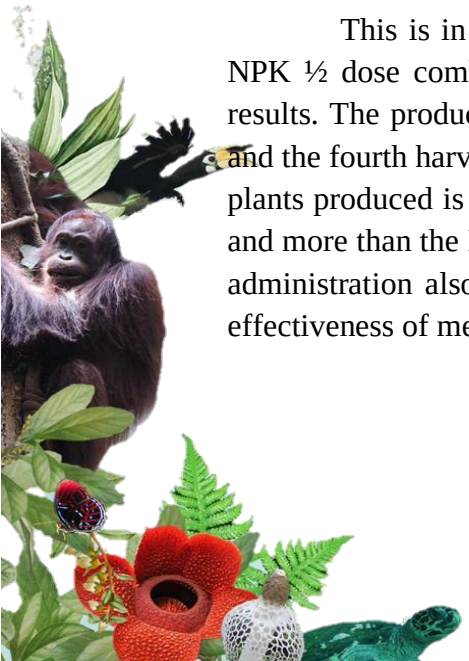
and highest fruit diameter at D_3F_1 (30 ppm organic fertilizer dose and frequency of administration every week). After Anova test was carried out on: weight per fruit, number of harvested fruit and weight of harvested fruit, that the interaction of organic fertilizer dose and frequency of fertilizer application were not significantly different, but significantly different in fruit length and fruit diameter.

Table 7. Effect of Organic Fertilizer Dose Interaction and Frequency of Aplication on: Fruit Length, Fruit Diameter, Weight per Fruit, Number of Harvested Fruits, Weight of HarvestedFruits

Treatment	Fruit Length (cm)		Fruit Diameter (cm)		Weight per fruit(gr)		Number of Harvested (cm)		Weight of Harvested Fruit (gr)	
	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P
D_0F_1	6,99	3,36	0,39	0,49	1,31	1,01	16,00	40,33	20,59	39,4
D_1F_1	8,70	3,19	0,42	0,48	1,36	0,96	28,67	31,67	40,03	32,93
D_2F_1	8,67	3,37	0,48	0,53	1,59	0,94	42,67	46,67	70,83	51,17
D_3F_1	10,22	3,51	0,48	0,54	1,67	1,06	43,33	60,00	72,30	63,3
D_4F_1	9,57	4,08	0,49	0,57	1,79	1,20	45,33	56,67	82,04	71,47
D_0F_2	8,83	2,57	0,45	0,46	1,54	0,90	35,20	10,33	57,16	13,00
D_1F_2	6,43	3,30	0,28	0,49	1,21	0,87	15,33	8,67	18,12	17,80
D_2F_2	6,53	3,26	0,33	0,45	1,32	0,84	16,33	21,67	20,58	18,17
D_3F_2	7,28	2,94	0,37	0,56	1,50	0,65	22,67	33,33	34,91	22,87
D_4F_2	8,73	3,32	0,40	0,53	1,60	0,96	40,67	11,00	63,35	10,57

The results of observations of the average dose of Beyonic StarT-mik @ lob organic fertilizer and the frequency of aplication of fruit diameter, fruit length, weight per fruit, fruit number, fruit weight can be seen in table 8. Fruit diameter, fruit length, highest weight of cayenne pepper in the D_4F_1 treatment (0.57 cm, 4.08 cm and 1.20 grams). The highest number of harvested fruit, harvested fruit weight and number of seeds per fruit in D_3F_1treatment (49.27 grams, 60.0 grams and 63.30 seeds). After Anova test of fruit diameter, fruit length, fruit weight, number of fruit harvested, fruit weight, the interaction between organic fertilizer dose and frequency of fertilizer application, the dose of organic fertilizer was not significantly different, but the frequency of fertilizer application was significantly different in fruit weight per fruit, amount fruit and fruitweight.

This is in accordance with the research of Juhaeti and Lestari (2016) that the NPK ½ dose combined with Beyonic StarT-mik @ lob organic fertilizer gives good results. The production of cendrung fruit is high until the third harvest on fingerplants and the fourth harvest on the index eggplants then decreases. The total number of fruits / plants produced is proportional to the NPK application combined with Commercial PO and more than the NPK combined with Megarhizo. The response of plants to megarhizo administration also tends to be unstable, so there is not enough data to conclude the effectiveness of megarhizo fertilizer to reduce NPK fertilizer in the future. When totaled



for six harvests, NPK fertilizer gives the best results, followed by the administration of NPK combined with POKomercial and NPK combined with Startmik. Ananty's research (2008) states that, fertilizer treatment with a combination of 50% inorganic fertilizer and organic organic fertilizer (POH) significantly increases plant height and number of caisin leaves. Starting at the age of three weeks after planting (3 DAP) shows that plants that received 100% NPK treatment and plants that were given organic organic fertilizer (Fertismart, Biost, and Ponti treatment combined with 50% NPK) experienced much more rapid growth than controls and DOP + 50%N

Observation of Beyonic StarT-mik @ lob organic fertilizer dosage on fruit length, fruit diameter, weight per fruit, number of fruit, and weight of chili and cayenne can be seen in Table 8. Fruit diameter, weight per fruit, number of fruits, and the highest weight of chilli fruit in the D_4 treatment (0.472 cm, 1.722 grams, 43.5 fruits and 75 462 grams) while the Fruit length, in per dose D_3 (9,475 cm).

Fruit length, fruit diameter, and highest weight per fruit of cayenne pepper at D_4 treatment (0.55 cm, 3.70 cm and 1.08 gram). The number of fruits, and the highest fruit weight in the D_3 treatment (38.27 grams, 46.67grams).

Table 8. Effect of Organic Fertilizer Dose Interaction and Frequency of Aplication on: Fruit Length, Fruit Diameter, Weight Per Fruit, Number of Harvested Fruits, and Harvest FruitWeight

Treatment	Fruit Length (cm)		Fruit Diameter (cm)		Weight per fruit(gr)		Number of Harvested(cm)		Weight of Harvested Fruit (gr)	
	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P
D_0	6,71 a	2,97	0,33 a	0,48	1,26	0,96	15,66	25,33	19,35	26,20
D_1	7,61 ab	3,25	0,37 ab	0,54	1,34	0,92	22,50	20,17	30,30	25,37
D_2	7,97 bc	3,25	0,42 bc	0,54	1,54	0,92	32,66	20,17	52,87	25,37
D_3	9,47 d	3,23	0,44 bc	0,55	1,63	0,86	42,00	46,67	67,83	43,09
D_4	8,58 c	3,7	0,47 c	0,55	1,72	1,08	43,50	33,84	75,46	41,02

Note: Numbers in the same column and followed by the same letter, are not significantly different in DMRT level 5%

Observation of the average frequency of Beyonic StarT-mik @ lob organic fertilizer on fruit length, fruit diameter, weight per fruit, number of fruits and weight of chili and cayenne can be seen in Table 9. Fruit diameter and length of chili fruit show significant differences between frequency once a week to once every two weeks but not significantly different in weight per fruit, number of fruit, and fruit weight. The diameter of fruit and length of cayenne pepper showed no significant difference between the frequency of organic fertilizer application once a week to twice a week but significantly different in fruit weight, number of fruits, and fruitweight.

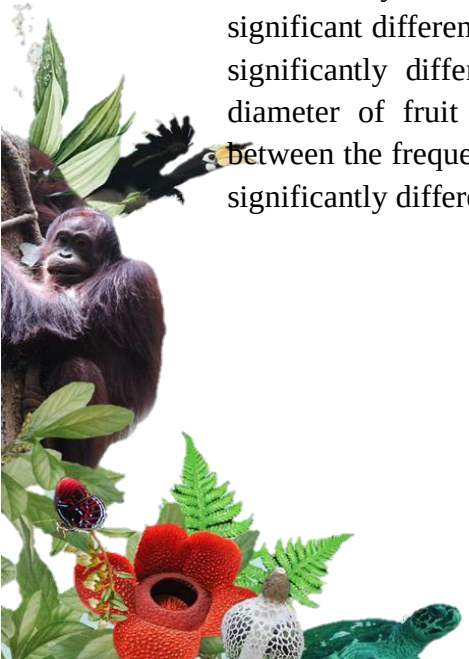
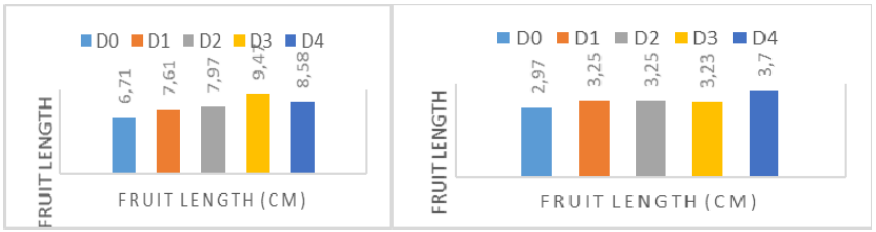


Table 9. Effect of Frequency of Organic Fertilizer on Fruit Length, Fruit Diameter, Weight of Fruits Per Plant, Number of Fruits and Weight of Harvest Fruits

Treatment	Fruit length (cm)		Diameter of fruit(cm)		Diameter of fruit(cm)		Number of Fruit(buah)		Weight of fruit (g)	
	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P	Chilly	C.P
F_1	8,83 a	3,50 a	0,45 a	0,54 a	1,54 a	1,03 a	35,20 a	47,07 a	57,16 a	51,65 a
F_2	7,32 b	3,08 a	0,37 b	0,50 a	1,46 a	0,84 b	27,33 a	17,00 b	41,17 a	16,48 b

Keterangan : Angka-angka pada kolom yang sama dan diikuti huruf yang sama, tidak berbeda nyata pada DMRT taraf 5 %

Graphs of fruit length, fruit diameter, weight per fruit, number of harvested fruit and weight of harvested fruit can be seen in Figures 5, 6, 7, 8, and9.



A. Cabaimerah B. Cabai rawit

Figure 5. Average length of Chilly fruit (left) and Cayenne pepper (right) at treatment Dose OrganicFertilizer

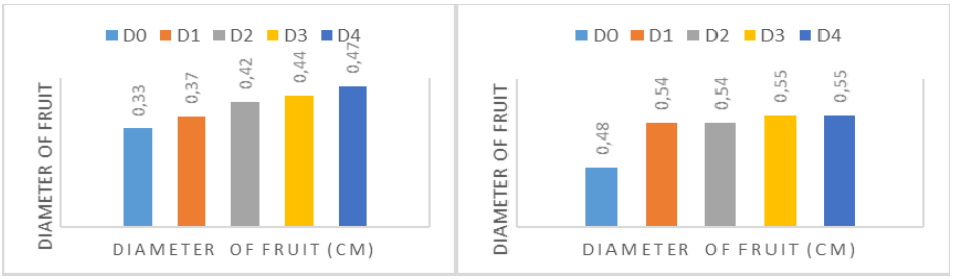


Figure 6. Average Diameter of Chilly fruit (left) and Cayenne pepper (right) at treatment Dose OrganicFertilizer

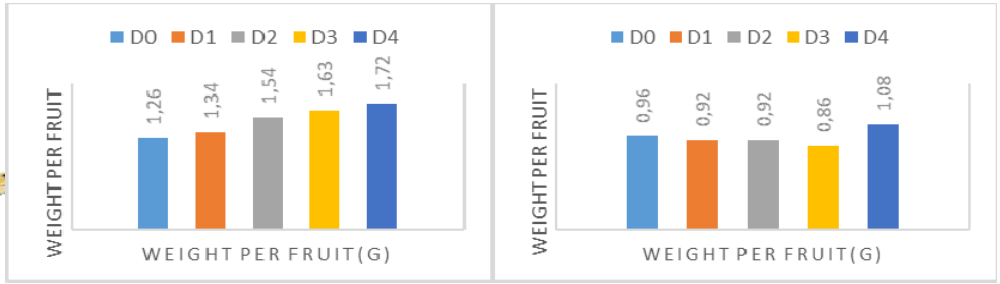


Figure 7. Average Weight Per of of Chilly fruit (left) and Cayenne pepper (right) at treatment Dose Organic Fertilizer

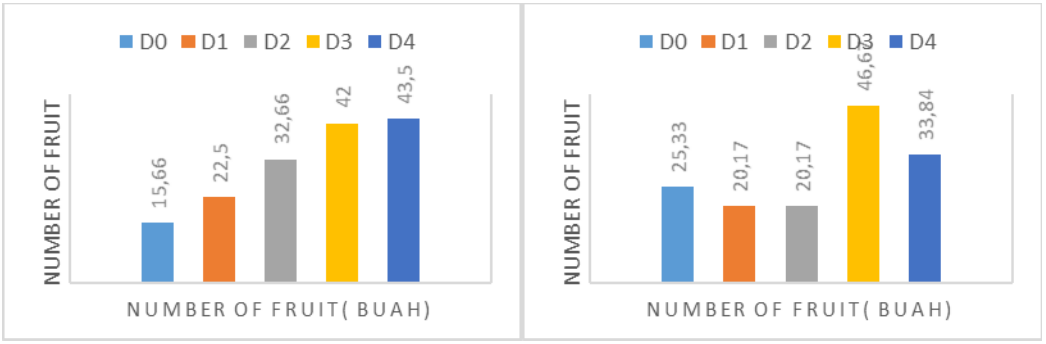


Figure 8. Number of Fruit Chilly (left) and Cayenne pepper (right) at treatment Dose Organic Fertilizer

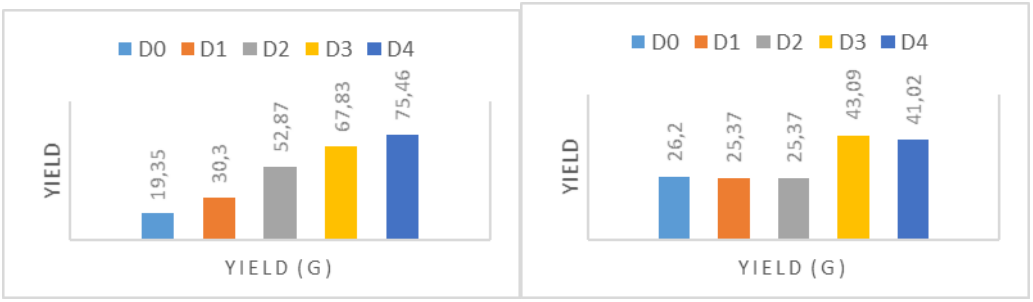


Figure9. Weight of Chilly fruit (left) and Cayenne pepper (right) at treatment Dose OrganicFertilizer

IV. CONCLUSIONS AN DSUGGESTION

Conclusion

The results of the study of chili and cayenne pepper showed that, the best frequency of fertilizer application was once a week. The chili research results, at the highest dose of 40 ppm POH for plant height, stem diameter, fruit diameter, weight per fruit, number and weight of fruit while at a dose of 30 ppm the longest fruit length. The results of the study of cayenne pepper showed that, at a dose of 30 ppm POH. plant height, the number of fruits, the highest fruit weight and number of seeds / fruit while at a dose of 40 ppm, stem diameter, fruit diameter, fruit length, and highest fruit weight.

Suggestion

It is also advisable to conduct further research to analyze the capsaicin content of chilies with an increase in Beyonic Magnetic POH dose.

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ANATOMY AND SECRETORY CELL STRUCTURE IN TROPICAL MEDICINAL PLANTS

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Abstract

The use of medicinal plants to overcome diseases has been used since ancient times because in these plants contain secondary metabolites which can be used as medicine. Secretory cell is the place that produce and save secondary metabolites in the plant tissues. The aim of this research is to observe the anatomical structure and form or the secretory cell density of medicinal plants. The sample used are *Anredera cordifolia*, *Syzygium polyanthum*, *Chromolaena odorata*, and *Piper betle*. Anatomical features were analyzed based on transversal sections of petiole, midrib, and lamina of fresh leaves by using free-hand sectioning using razors. Observations consisting of leaf anatomical structure of cells of the epidermis, the stomata and the secretory cells per unit area in the leaf of four tropical medicinal plants. The medicinal plants containing some of the secondary metabolite compounds. Microscopic observation found several types of secretory structure in leaves observed oil cavity cells were found in *Syzygium polyanthum* leaves and *Anredera cordifolia* leaves. In addition, there were found another form of secretory cells in *Chromolaena odorata*, and *Piper betle*. In epidermal cell, it showed the anatomy of stomata type from the leaf of medicinal plant are paracytic, anomocytic, and tetracytic stomatatype.

Keywords : anatomical structure, leaves, medicinal plants, secretory cell

I. INTRODUCTION

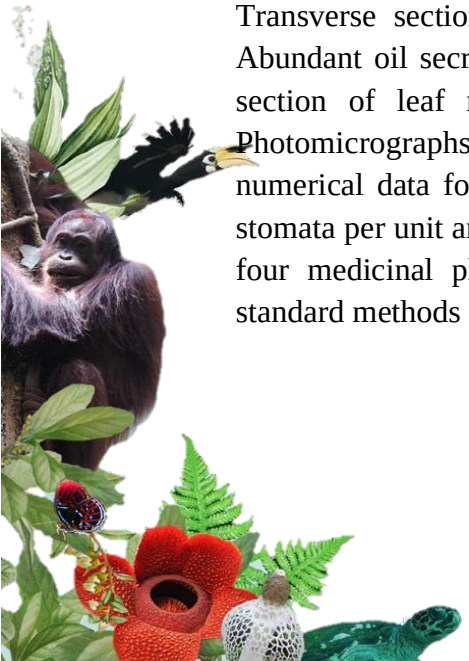
Indonesia has been known megabiodiversity of plants. We have various plants. Some of them is medicinal plants. The research of medicinal plant in Indonesia are still fewer than the abundance. No report more has so far been given on the anatomical structure of medicinal plants were investigated. Anatomy of plant is the building block to understand the nature of how plant tissue works in terms of metabolomics, functional biology, molecular biology and its function, as the core unit for characterisation, taxonomic identification and phylogenetic analysis of plant (Raman et al. 2017) and the need for further investigating the pharmacological aspects of medicinal plants. So, the research that has been conducted aimed to evaluate the anatomical characteristics of medicinal plants leaves and to determine whether there are differences in the structure of their secretory tissues of medicinal plants. The anatomy characteristics of medicinal plant including stomatal cells, presence of unicellular hairs in the abaxial leaf surface of medicinal plants, different shapes of vascular bundle in the midrib andpetiole.

Anredera cordifolia (Ten.) Steenis, better known name is Binahong in Indonesia and be classified in the angiosperm family Basellaceae, often be used for

traditional medicines to treat diabetes, relieve shortness of breath, stabilize blood pressure, coughing and vomiting blood, lung disease, accelerate wound healing process, restoring bruised, headache, hives, immune system, nose bleeding, prevent stokes and health problems after the surgery and childbirth (Manoi & Ballitro 2009), (Hadian 2010). *Syzygium* is the largest genus that widely used for the treatments of diabetes, cancer, endometriosis, hypertension and also used as *ulam*. The boiled and dried leaves of *Syzygium polyanthum* are used as medicinal materials to treat many ailments including diabetes, cancer, hypertension and endometriosis (Hussin et al. 1992). *Chromolaena odorata* is one of four species that belong to the family Asteraceae (Compositae). This family is the largest family of flowering plants comprising of 1,100 genera and 20,000 species (Omotable 1965). A recent review, *C. odorata* are used for ethnopharmacological, including treatment of malaria, wounds, diarrhoea, skin infection, toothache, dysentery, stomach ache, sore throat, convulsions, piles, coughs and colds. *Piper betle* has been known in traditional medicine plants that have been associated with the control of caries and periodontal diseases and to the control of bad breath. These leaves are traditionally used for chewing in their natural raw condition which is a product called 'pan'. According for the research (Fathilah et al.2000) showed that the crude aqueous extract of *Piper betle* L. leaves exhibits antibacterial activity towards *Streptococcus mitis*, *Streptococcus sanguis*, and *Actinomycesviscosus*.

II. RESEARCH METHODS

A total of fresh bay leaves belonging to four medicinal plants were obtained from various sources. All of the samples were observed for anatomical studies. Free-hand sections were prepared from tissues from the middle regions of the leaves. Fresh leaves of *Anredera cordifolia*, *Syzygium polyanthum*, *Chromolaena odorata*, dan *Piper betle* were obtained from wild plants in Jakarta and Bogor. Three to five medium-sized mature leaves were collected from the live plants and used for comparative analyses of anatomical features. For anatomical studies, fresh leaves were used when available. Anatomical features were analyzed based on transversal sections of petiole, midrib, and lamina of fresh leaves that were obtained by free-hand sectioning using razors. Transverse sections of the leaves of the tropical medicinal plants were prepared. Abundant oil secretion glands were observed in medicinal plants from the transverse section of leaf midrib. The anatomical features were observed and compared. Photomicrographs were prepared using light microscopes (Nikon). Measurements and numerical data for various microscopic features, such as size of stomata, number of stomata per unit area, stomatal index, vein-islet number, midrib and leaves petiole from four medicinal plants were prepared for the investigated bay leaf samples using standard methods and werecompared.

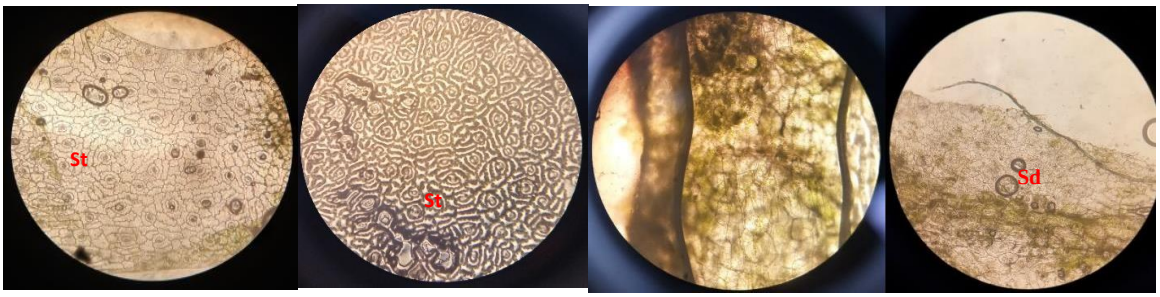


Preparation of stomata with replication method. The method used is descriptive qualitative to describe and interpret the type of stomata on the leaves of the medicinal plants family. The stomata that have been there, categorized less if there are 1-50 stomata, enough if there are 51-100, more if there are 101-200, and the most if there are 201- >300.

III. RESULTS AND DISCUSSION

The leaves emergence of four medicinal plants showed some similarities in their basic anatomical features. The leaf blades were dorsiventral with a well-developed mesophyll made up of palisade and spongy tissues. The laminae were hypostomatic, i.e., having stomata only on the abaxial surface. All of the four medicinal plants of leaves possessed spherical oil cells (secretory cells) containing essential oil distributed in themesophyll.

Based on the result of this study found the type of stomata in *A. cordifolia* plant, that is paracytic type with the stomata density of *A. cordifolia* are 98 (abaxial) and 48 (adaxial) (Fig.1).

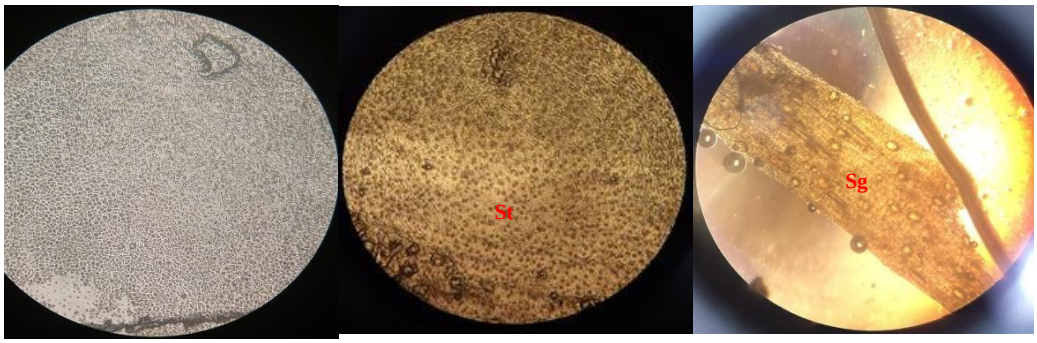


(a) (b) (c) (d)

Figure 1. The anatomy of transverse section of *Anredera cordifolia* leaves. (a) Adaxial side of the epidermis, (b) Abaxial side of the epidermis, (c) Petiole side of *A. cordifolia*, (d) Midrib side of *A. cordifolia.* (St: Stomata, Sd: Secretory duct)

Based on other research, the extract of *A. cordifolia* leaf have effect as anti-inflammatory, antioxidant, antibacterial, and as an analgesic. The active compounds, such as saponins, alkaloids, polyphenols, flavonoids, and glycosides that have an effect on the wound healing process (Purwasih et al. 2018).

The *Anredera cordifolia* leaves had very narrow veins and no sclerenchyma, suggesting a low construction cost that is associated with invasive plants. The anatomy of *A. cordifolia* was similar to that of *Basella alba* L. (Boyne et al. 2013).

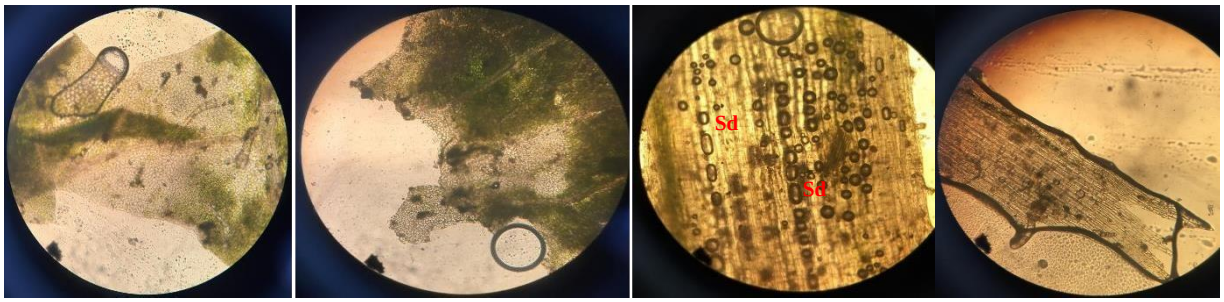


(a) (b) (c)

Figure 2. The anatomy of transverse section of *Syzygium polyanthum* leaves. (a) Adaxial side of the epidermis, (b) Abaxial side of the epidermis, (c) Midrib side of *S. polyanthum.* (St: Stomata, Sg: Secretorygland).

Based on the result of the study found the type of stomata in *S. polyanthum* plant, that is anomocytic type with the stomata density of *S. polyanthum* are > 300 for abaxial and adaxial (Fig.2). No trichome was found in *S. polyanthum* but glandular trichome was found in the less developed leaves around the midrib and lamina transverse section, and the presence of oil secretion gland in *S. polyanthum*, which is a clear indication of the production of oxalate crystals and phenolic compounds or essential oil which is responsible for the aromatic odour and sweetness of the plant (Abdulrahman *et al*. 2018). Trichome have the ability of detecting pathogen infections in plants which in turn indicating the medicinal potential of a plant and had the ability to withstand drought tolerance through enhancing condensation of moisture from air (War et al. 2012), (Dalin et al. 2008). Epidermis cells of *S. polyanthum* can well be seen clearly abundance of oil secretion glands all over the petiole (Fig. 2). The presence of multifaced oxalate crystal and glandular trichome found in laminar transverse section has been a distinct character for some *Syzygium*cultivars.

Based on the result, *Chromolaena odorata* has anomocytic for the type of stomata with the stomata density of *C. odorata* are not clear for abaxial and adaxial (Fig. 3). Frequency of stomata per unit area is 117 (73-160), frequency of epidermalcell per unit area is 419 (262-576), and the stomatal index (%) (S.I.) is 21.76 (Unamba *et al*. 2008).

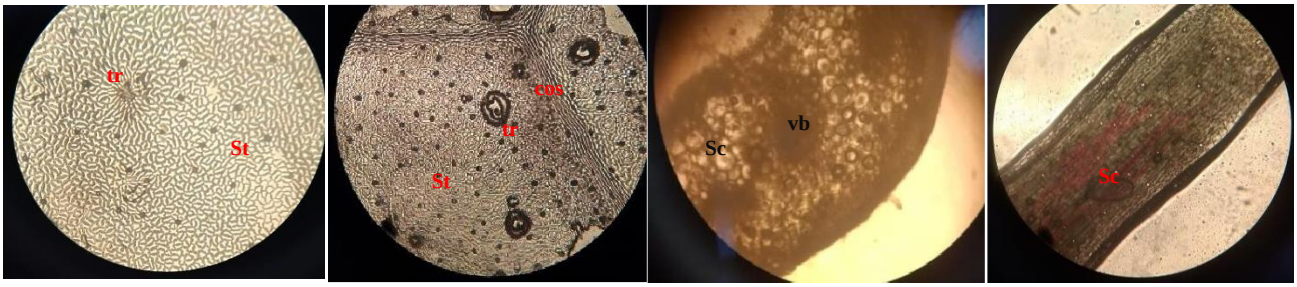


(a) (b) (c) (d)

Figure 3. The anatomy of transverse section of *Chromolaena odorata* leaves. (a) Adaxial side of the epidermis, (b) Abaxial side of the epidermis, (c) Midrib side of *C. odorata*, (d) Petiole side of *C. odorata.* (Sd: Secretoryduct)

Chromolaena odorata is the species of medicinal plant with secretory ducts. The character are dependable in delimitating the members of this species in the same family. Despite the occurrence of the secretory ducts, the nature of abaxial and adaxial parenchymatous cells, the shape, number and arrangement of vascular bundles in the midrib vary among the species studied and could be used to distinguish them. *Chromolaena odorata* midrib has arced vascular bundles with 5 vascular bundles (3 separate traces and 2 medullary ones) with the abaxial and adaxial parenchymatous cells4-6 and 5-7 layers, respectively and the middle portion of the midrib elevated but flattened at the apex (Fig.3) (Ekeke & Mensah 2015).

Based on the result of the study found the type of stomata in *Piper betle* plant, that is tetracytic type with the stomata density of *P. betle* are approximately 200 for abaxial and adaxial (Fig.4).



(a) (b) (c) (d)

Figure 4. The anatomy of transverse section of *Piper betle* leaves. (a) Adaxial side of the epidermis, (b) Abaxial side of the epidermis, (c) Petiole side of *P. betle,* (d) Midrib side of *P. betle.* (St: Stomata, tr: glandular trichomes, cos: costal cells, Sc: Secretary cell, vb: vascular bundles).

Adaxial side of the epidermis, in face view showing glandular trichomes, which have unicellular apical cell and a short pedicel. Adaxial side of the epidermis also have tetracytic stomatal complex, costal cells, conjugation tubes, and twin stomata. Abaxial side of the epidermis in face view showing cyclocytic stomatal complex, balloon like epidermal cells, and rosette of epidermal cells. The leaves are hypostomatic, tetracytic stomatal complexes are common which is the characteristic feature of the Piperaceae (Lakshmi & Naidu 2010). The petiole anatomy of leaf have many vascular bundles and oil cavity of leaf or secretarycells.

There are variations in the surface sculpturing pattern of two surfaces (abaxial and adaxial) and each of four medicinal plants. The sculpturing surface pattern of plants leaves as one of the key features for taxonomic of plants (Haron *et al*. 2015).

Nevertheless, the leaves of several other species including *Syzygium polyanthum* are commonly substituted or mistaken for true bay leaves due to their similarity in the leaf morphology, aroma, and flavor. The true bay leaf and its substitutes also showed significant differences in their leaf anatomies (Fig. 2). The leaves of *S. polyanthum* and *A. cordifolia* had thick cuticles on the adaxial surface, whereas the cuticles were usually about 2–5 µm in the other four species. Trichomes were not observed in the other two species. Glandular trichomes were present in the leaves of *Syzygium polyanthum* and *Piper betle* but absent in the leaves of all of the two medicinal plant species included in thisstudy.

The secretory cells (Fig. 1 and Fig. 4), appearing as transparent dots in the leaves, but they were found on epidermis. They both in the palisade and spongy tissues, midrib, veinlets, and sometimes in the lower epidermises in the case of four medicinal plants. The secretory cells were spherical or rarely oval in shape and sheathed by a layer of cells with suberized and lignified walls. In this research, the secretory cell walls were not stained staining because the secretory cell can be emergence clearly. The contents of the oil cells were homogenous and were usually yellowish, often showing bubbles. In *Chromolaena odorata,* the secretory cells were smaller than the mucilage cells, and were predominantly located on the veins and were rarely found within vein-islets (Fig. 3). But there was no relationship between the density of secretory cells per unit area with antioxidantactivity.

The oil cells in *S. polyanthum* were also attached to the epidermis by a multicellular stalk, but the point of attachment had a single central cell in contrast to two cells. The secretory cells located in the palisade region were attached to the epidermal cells without a stalk. Some of the oil cells in this species were found to be located directly in the lower epidermis where the epidermis formed a gap exposing the oil cell wall to the outer space.

Stomata were present on the abaxial and the adaxial epidermis in all of the four medicinal plants species included in the study. The stomata were slightly sunken in all ofthefourspecies.Theyweremainlyofanomocytic,paracytic,andtetracytictypes.

Twin stomata, i.e., stomata occurring in pairs, were observed in *A. cordifolia*. Slight differences in the stomatal size were observed among the four species. The stomata of *A. cordifolia* were the longest (up to 35 µm). The least number of stomata per mm^2 area (≤ 100) was observed in *Anredera cordifolia* while *S. polyanthum* had the highest (> 300) number of stomata and *Piper betle* had more number of stomata (200). As the another research indicated that *C. odorata* have secretory duct (Ekeke & Mensah 2015). This research is the same of another research but the stomata index of four medicinal plants have difference. The difference on the effect of light intensity in the areas of each plant habitat have influenced the stomata index. Research parameters was amount and distribution of leaf stomata, further more data classification in categorizing few to not limited. Result of this reseach showed that few category amount stomata was reach 12.5%, enough 12.5%, more 25%, most 25% and 25% not limitcategory.

Epidermal characters were initially used by only Palaebotanists in the classification of non-angiosperms. Their application later to modern angiosperms showed that they can be a very important tool of the taxonomists and the evolutionists. The use of epidermal characters such as stomatal types, trichome types, stomatal frequency or index in classification seems to be increasing rapidly because not only do epidermal characters correlate with gross morphological features in most cases, they are often known to be very valuable at the levels where classical methods of cytology and genetics can not be applied (Stace 1965). So, the epidermal features are not very useful at species and genera levels.

IV. CONCLUSIONS

In conclusion, anatomical features of the leaves of four medicinal plant species have some variations. Glandular trichomes were present in the leaves of two medicinal plants species but the secretory ducts were present in all of four medicinal plants species. The number of stomata have categorized few category amount stomata was reach 12.5%, enough 12.5%, more 25%, most 25% and 25% not limit category. They were mainly of anomocytic, paracytic, and tetracytic types. Several anatomical and micromorphological features, can be helpful in characterizing the true bay leaf and its substitutes. The result of the research indicated that the adaptation of medicinal plants anatomically is more completely thanmorphologically.

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THE EFFECT OF SIZE OF FLOUR AND SPEED OF BLOW to CACIUM OXALATE IN ILES-ILES (*Amorphophallus muelleri*)

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Abstract

Calcium oxalate (CO) is a secondary metabolite found in the iles-iles tubers (Indonesian Konjac, IK in brief), is considered useless, as a cause of irritation and itching on the skin. CO is grouped into inorganic compounds which can be reduced or eliminated through a mechanical proccess, which isolates starch by blowing. The shape, size, and amount of CO in IK depends on the type and environment of growth. In our study, it formed a flour size of 30, 40 mesh and set wind gusts at a certain speed. Glucomannan is the final product of the process. The purpose of this study was to determine the effect of flour size and blowing velocity on CO inIK.

Keywords: Calcium oxalate, flours, iles-iles (*Amorphophallus muelleri*), speed, and size of flours

I. INTRODUCTION

Iles-iles (*Amorphophallus muelleri*) IK in brief is one of the Araceae family's annual herbaceous plants, the Monocotyledoneae class, grows well in tropical countries such as Japan, China, Thailand, Vietnam, Cambodia and Indonesia (Jansen et al., 1996). Iles-iles produces tubers which when processed in agro-industry will produce glucomannan. Glucomannan is a hydrocolloid, a polysaccharide compound that has high economic value because it has many benefits. The benefits of glucomannan in the industry include food ingredients (konyaku and shirataki) to reduce obesity, anti-diabetes mellitus, reduce blood cholesterol levels, gel-making materials, thickening waste or mining waste, making emulsions, stabilizing solutions, and forming gel structures. Glucomannan can be useful as an anti-human immunodeficiency virus (anti-HIV), and anti-blood clotting (Chua et al., 2012; Bo et al., 2013). Iles-iles is widely planted on Perhutani's land under teak, mahogany, and sonokeling stands. To get good growth, planting requires shade trees that can inhibit sunlight between 50-60%. Iles-iles cangrowwellataltitudesupto1000metersabovesealevel,temperaturesbetween25-

35, and rainfall between 300-400 mm per month. The iles-iles tubers are harvested when they are two years or older. Tubers are harvested when the plant enters the dry season between May and August, when the plant enters a period of rest or dormancy (Ohtsuki 1968; Sumarwoto2005).

Calcium oxalate in plants comes in two forms: water soluble and water insoluble. Oxalates that dissolve in water when consumed by humans can cause bioavailability of calcium in the body and cause kidney stone disease, whereas those that are not soluble in water can cause itching and irritation (Noonan dan Savage, 1999). The total weight of calcium oxalate monohydrate decreases with increasing melanin concentration. The iles-iles flour contains ± 0.76% bw, or 1.03% bk (Thanasekaran *et al*., 2012). Oxalic acid in plants is found in the form of oxalic acid (solution) such as potassium oxalate ($K_2C_2O_4$), sodium oxalate ($Na_2C_2O_4$), and ammonium oxalate $(NH_4)_2C_2O_4$ and insoluble forms such as calcium, magnesium, and iron oxalate (Indriyani et al. (2011). Oxalate content in plants is highest in tubers and leaf organs (Hang et al., 2013). Boiling or cooking can reduce oxalate in food if it is cooked with water (Novita *et al*.,2013).

Several studies on the reduction of calcium oxalate carried out by (1) Iwuoha and Kalu (1995) produced an average reduction of 70% in boiling treatments at 90 ° C for 40 minutes, (2) Huang and Hollyer, (1995) produced itching reduction without gelatinization of starch in the treatment of tubers in warm water at a temperature of 38-48 ° C for less than four hours, (3) Prabowo (2010) can reduce calcium oxalate with 40% efficiency in treatment with soaking 4.5% NaCl up to five times over iles-iles tuber slices, and (4) Chotimah and Fajarini (2013) by boiling taro tubers with NaCl can reduce calcium oxalate levels until they are suitable forconsumption.

The iles-iles flour contains calcium crystals which can cause itching,skin irritation and cannot be consumed directly. The presence of crystals is very important for health and protection as a barrier for food and industry. Until now, the most effective and efficient way to remove calcium oxalate crystals had not been found in iles-iles flour. In order to be used, calcium oxalate crystals must be removed in various ways, one of which is mechanical by reducing wind size and resistance. Our aim in this article is to explore the effect of iles-iles flour size and wind speed on calcium oxalate crystal content with the hope that the smaller the flour size and the faster the wind blows the lower the calcium oxalate crystal content contained iniles-flour.

II. RESEARCH METHODS

A. Study area

This research was conducted for 6 months (April to September 2017), conducted at the Laboratory of the Faculty of Agriculture at the National University, Bambu Kuning, South Jakarta. SEAFAST IPB Center, and Chemical Laboratory,

Bogor Agricultural University, Bogor. The research consisted of 2 treatments of flour size, 40 mesh and 2 wind gusts, 160 cm / sec and 210 cm / sec.

B. Materials research

The main raw material used in this study is the iles-iles tubers obtained from iles-iles farmers in Klangon Village, Saradan, Madiun, East Java Province.

C. Procedures

The iles-iles bulbs are washed clean, peeled, and sliced into wet chips with a thickness of 5-6 mm. The oven is dried until the moisture content reaches ± 10%. Milled into flour with a size of 40 mesh. Made into 4 groups with 500 g of flour each. Each group was blown off at a distance of 75 cm with speeds of 160 cm / sec and 210 cm / sec. The number of replications per treatment is twice. The calcium oxalate crystal content was analyzed using the AOAC method (2012): 968.08. Data processing is done by the SAS system method with the GLM procedure.

D. Data Analysis

This study used a complete random design with 40 mesh flour size treatment and 160 and 210 cm / sec wind gusts, each treatment was repeated 2 times. The number of trial units is 4 units. The parameters observed included: calcium oxalate crystal content in each treatment (mg / g sample).

III. RESULTS AND DISCUSSION

Wind speed affects the calcium oxalate crystal content of 40 mesh iles-iles flour. Data on calcium oxalate crystal content in various gusts and 40 mesh flour size are shown in Table 1.

Table 1. Effect of iles-iles flour size and wind speed on calcium oxalate crystal content (ppm)

Treatment	Calcium Oxalate Content (ppm)	
	average	Deviation standard.
A_1B	1240.23[a]	± 7.95
A_2B	871,47[b]	± 5.69

Note: numbers with different letters in one column show significant differences at the 5% level
A1, A2: Wind gusts of 160 cm / sec and 210 cm / sec
B: flour size is 40 mesh iles-iles.

Table 1 explains the wind speed that blows significantly influences the calcium oskalat crystal content. A wind speed of 210 cm / sec produces a calcium oxalate crystal content in iles-iles flour measuring 40 mesh lower at 871.47 ppm, while a wind speed of 160 cm/sec calcium oxalate crystal content of 1240.23 ppm from the same sample weight of flour which is 500 gram. This shows that the treatment of wind gusts causes differences in the content of calcium oxalate crystals which are 40 mesh in size. Calcium oxalate crystals are chemical compounds in iles that are physically shaped like needles and stars, so that if they are reduced in size, calcium oxalate crystals will be cut into smaller pieces and more easily separated from flour by wind gusts. Dwiyono (2014) states that plant age factors affect calcium oxalate crystalline levels in additionto handling postharvest processes, laboratory handling results in lower calcium oxalate crystalcontentof0.87ppmwhilepostharvestprocessescarriedoutconventionallyare

ppm.

Calcium oxalate is used as one of the parameters that determines the quality of iles-iles flour because calcium oxalate can endanger human health, which is a trigger for skin irritation and kidney stone disease at high concentrations (Libert dan Francschi 1987; Thanasekaran et al. 2012; East et al.2013). Novita and Indriyani 2013 stated that the iles-iles Calcium oxalate tubers are needle-shaped and star-shaped crystals. The amount of calcium oxalate crystals in the iles-iles plant is affected by age, growth phase, season, nutrition, and land for planting. The amount of calcium oxalate crystals in the iles-iles plant is affected by age, growth phase, season, nutrition, and land for planting. Indriyani et al. (2011) states that there is a direct relationship between climate and nutrition with calcium oxalate content in iles, on the other hand there is an indirect relationship between diameter and amount and density of calcium oxalate in the tuber.

Table 1 also shows that the immersion treatment and drying method significantly influence Calcium Oxalate levels in dry chips iles-iles. Faridah et al. (2012), states that the increase in glucomannan levels is offset by a decrease in other components such as Ca-oxalate, protein, fat, ash, and starch.

IV. CONCLUSIONS

The fan blowing speed has a significant effect on the content of 40 mesh Calcium Oxalate flour. A wind speed of 160 cm / sec or switch number 1 on the fan produces a high crystal content of 1240.23 ppm, while a speed of 210 cm / sec or switch number 2 produces a lower Calcium Oxalate content, 871.47 ppm.

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THE APPLICATION OF KEPOK BANANA PEEL ACTIVE CHARCOAL FOR DOMESTIC WASTE MANAGEMENT

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Abstract

Increased water pollution especially in rivers passing through urban and dense settlements caused by disposal of household waste in big cities still flows directly to water bodies. These domestic waste discharges when not properly managed can have a negative impact on the environment. To minimize the negative impact, it needs an effort to manage the liquid waste before it is discharged into the environment. One method used to treat domestic waste is by adsorption method. Adsorption is considered the best waste water treatment method because the cost is cheap and easy in the process of operation. The problem of adsorbent dose and contact time of kepok banana peel active charcoal have not been known yet and the adsorption mechanism of the kepok banana peel active charcoal itself still remains unknown too. Based on the background and the problems, this research aims to find the dose and time of kepok banana peel active charcoal in reducing BOD of domestic wastes. Laboratory experiments with batch adsorption to determine the adsorbent dose (0.01 – 0.05 g/ mL) and contact time (5 – 20 minutes) are optimum. The research begins with the of adsorbent which is kepok banana peel active charcoal, taking and preserving domestic waste samples, testing of waste characteristics, batch adsorption process and data processing. This research used Randomized Complete Random Design with two factors: adsorbent dosage (0, 0.01, 0.02, 0.03, 0.04 and 0.05 g/ mL) and contact time (5, 10, 15 and 20 minutes). Each treatment was repeated 3 times. The total number of experimental units is 75 experimental units. The dependent is organic matters as permanganate value. The obtained data were analyzed by using software with one way ANOVA program Statistical Product and Service Solution (SPSS) 22.0. Tukey HSD Test (BNJ) in level 5% used in this research to know the effect of treatment level. The result showed that the adsorbent dose and contact time did not affect the adsorption capacity of activated charcoal against Fe. The most optimal dose of adsorbent and contact time in reducing Fe level in solution was 20 minutes contact time and 0.02 g/ L adsorbent dose.

Keywords: Active charcoal, Kepok banana, Waste

I. INTRODUCTION

Increased water pollution, especially in rivers that pass through cities and densely populated settlements, is caused by the disposal of household waste in major cities, each channeling directly into water bodies. The effect that can be caused is the occurrence of environmental damage to household waste disposal sites, such as rivers, swamps and coastal waters.

Domestic waste is all waste material originating from bathrooms, latrines, kitchens, washing areas and washing dishes. Domestic wastewater has a very wide area of distribution and generally consists of household waste, offices and restaurants.In general, people dispose of waste originating from toilets into septic tanks and runoff water is absorbed into the ground or discharged into public drains, while non-toilet waste water, which originates from bathing, washing and kitchen waste, is discharged directly into public channels (Tato, 2004).

The large amount of toilet liquid waste discharged into water bodies will cause water pollution. According to Silalahi (2010), pollution caused can be direct or indirect. Be direct, for example a decrease or increase in temperature and pH will cause disruption of biota life. While the indirect effect is oxygen deficiency because the amount of oxygen needed to break down waste will increase.This domestic waste disposal if not managed properly can have a negative impact on the environment. To reduce these negative impacts, an effort to manage liquid waste is needed before it is discharged into the environment.

One method used to treat domestic waste is the adsorption method. Adsorption is considered the best method for treating wastewater because of the low cost and eases of operation (Aliet al. 2012).Various types of materials can be used as adsorbents such as alumina, silica, zeolite and activated charcoal. According to Gupta et al., (2009) activated charcoal is the type of adsorbent that is most often used because the process of adsorption of activated charcoal is very useful and effective in purifying waste because it can remove organic pollutants from water. Activated charcoal can be made from various types of carbon-containing materials such as new stones, coconut shells, coconut shells, palm oil, rice husks, sawdust and others(Aliet al., 2012).

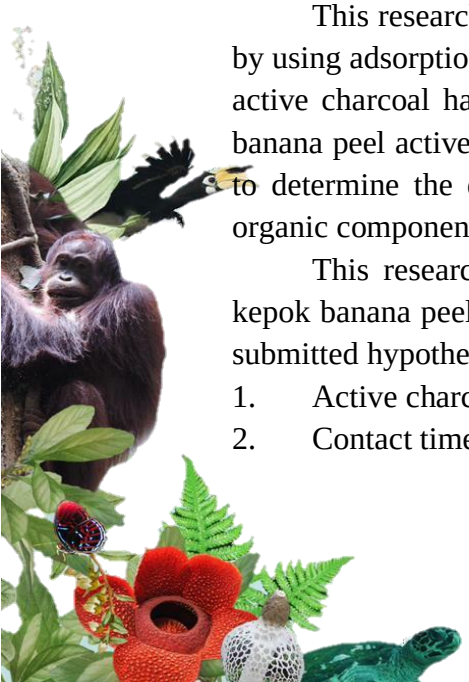
In this research, the material chosen as the raw material for activated charcoal is Kepok banana peel. The choice of banana peel as an active ingredient of charcoal is because banana peel is generally only used as food for livestock such as goats, cows and buffalo. Even in some areas they are still left as waste. One type of banana that is widely used by the community is the kepok.

According to Hewwet et al., (2011) in Endra (2013), kepok banana peel (*Musa acuminate balbisiana* Colla) contains various biochemical components that allow banana peel waste to be used as an ingredient for making activated charcoal.Activated charcoal is activated charcoal so that it has a fairly high adsorption power. Activated charcoal is crystallite consisting mostly of free carbon and has a large inner surface area, so it has good adsorption power. According to Othmer (1992) in Adinata (2013), activated charcoal is a porous substance containing 85 - 95% carbon, produced from materials containing carbon with high temperature heating so that a large surface area is obtained, ranging between 300 - 2000 m^2 / g.a.

This research is an experimental research that was done against the domestic waste by using adsorption method. Adsorbent dosage and contact time of the kepok banana peel active charcoal have not been known yet and the adsorption mechanism of the kepok banana peel active charcoal itself still remains unknown too. The aims of this research is to determine the dosage and the most optimum adsorbent contact time to reduce the organic component levels as permanganate value.

This research is expected to give information about the advantages of utilizing kepok banana peel active charcoal as an adsorbent for domestic waste management. The submitted hypotheses in the research are:

1. Active charcoal dosage will affect organic components levels.
2. Contact time of the active charcoal will affect organic matter levels.



II. RESEARCH METHODS

A. Time and research location

This research was conducted in 1 (one) even semester of 2017/2018 academic year at Chemistry Laboratory, Laboratory Center of Universitas Nasional, Jl. Bambu Kuning, Ps. Minggu, South Jakarta.

B. Tools and materials

1. Tools

A set of glassware, furnace, oven, blender, digital scale, shaker, 100 mesh strainer, porcelain plate.

2. Materials

Kepok banana peel (*Musa balbisiana* C.) and domestic waste.

C. Working procedures

1. Adsorbent making

Adsorbent that is used in this research is active carbon from kepok banana peel waste. Steps to make the active carbon are as follows:

a. Kepok banana peels are cut to 1 – 2 cm, then washed with the water until it is clean. After that, banana peels are dried or roasted until it is dry.

b. Furthermore, banana peel is carbonized until it is turned into charcoal in a furnace at a temperature of 400 degrees Celsius. During the process, the furnace is kept closed so that no incoming oxygen prevents ignition.

c. Banana peel charcoal is then ground and blended first, and sieved using a 100 mess strainer. The sifting process aims to obtain uniform sizes of activated charcoal.

d. Banana peel charcoal powder is activated with H_2SO_4 5% in 24 hours.

e. Activated banana skin charcoal is then filtered with filter paper and washed with hot water which is useful for removing impurities present in banana peel charcoal powder during soaking.

f. Clumps of activated charcoal powder of banana peels obtained, dried repeatedly in the oven at a temperature of 105 degrees Celsius aims to reduce the water content in the activated charcoal of banana peels. Refined and sieved with a size of 100 mesh. Ready to be used for adsorbing.

2. Domestic waste samples taking and preserving

Waste sample that will be the object of this research was taken from household waste, Komplek Perumahan Lereng Indah, Pondok Cabe Udik, Pamulang, South Tangerang. Then, samples will be preserved by cooling it down to temperature of <4 degrees Celcius.

3. Domestic waste samples characteristic testing

Water waste characteristics that will be tested, involving organic matter parameter by using permanganometry method.

4. Batch adsorption process

Batch adsorption process was conducted at laboratory at room temperature of ± 25 degrees Celsius. In the experiment, a 100 mL Erlenmeyer flask was prepared. Next in each container 10 mL domestic waste samples were added, then the activated charcoal adsorbent of kepok banana peel with various dosages of adsorbent 0.25 gram, 0.50 gram, 1 gram, 1.25 gram and 1.50 gram. Then the bottles were arranged on a shaker and stirred at a speed of 150 rpm in 30 minutes. Then re-measuring the PV value.

Repeat the experiment again with various contact time: 5 minutes, 10 minutes, 15 minutes and 20 minutes. Then, re-measuring the PV value.

5. Data analysis

Data processing of measurement results is performed by mathematical calculations as follows:

$$\text{The decrease of permanganate value (\%)} = \frac{(\text{Co} - \text{Ce})}{\text{Co}} \text{ x } 100\%$$

Co = initial permanganate value (%)

Ce = permanganate value after the adsorption (mg/ L)

C. Research plan

This research used a Factorial Complete Randomized Design (RAL Factorial) with 2 factors which are: the dose of adsorbent (0, 0.01, 0.02, 0.03, 0.04 and 0.05 g / mL) and contact time (5, 10, 15, and 20 minutes). Each treatment was repeated 3 times. The total number of experimental units is 75 trial units.

The obtained data were analyzed by using software with one way ANOVA program Statistical Product and Service Solution (SPSS) 22.0. Tukey HSD Test (BNJ) in level 5% used in this research to know the effect of treatment level.

III. RESULTS AND DISCUSSIONS

A. Water level

The water content of a material is very important to analyze because it aims to determine the hygroscopic nature of activated charcoal (Wijayanti, 2009). Moisture content of activated charcoal from banana peels produced in this study ranged from 1.20 to 1.35% (Table 1). The value of water content obtained in this study is in accordance with SNI-06-3730-1995 (BSN, 1995), which is the maximum water content in activated charcoal is 15%. The low water content produced shows that the free water content and bound water contained in the banana peel active charcoal has evaporated during the carbonization process. The desired water content of activated charcoal must be as low as possible because high water levels will reduce its absorption (Pari, 1995).

In addition, low water content also increases the surface area of activated charcoal because the evaporating substances or other compounds are more easily removed, so the absorption of activated charcoal will be better (Fauziah, 2009).

Table 1. Result for water level from banana peel active charcoal

Repetition	Water level (%)
1	1,31
2	1,31
3	1,20

B. Ash level

Ash content is the amount from the end of the high temperature combustion process. Residue that is formed in the form of mineral substances that are not lost during the combustion process. These minerals, for example, calcium, potassium and magnesium. The results of the ash content analysis in this study ranged from 2-3% (Table 2). The minimum amount of ash content in activated charcoal is 10%, so in this study the ash content was obtained in accordance with SNI-06-3730-1995 (BSN, 1995). The desired ash content must be as low as possible because it will affect the adsorption of gases or liquids when it takes place to be better. This is due to the mineral content in the ash can spread in the pores of activated charcoal and cover the active center (Pari, 1995). If the ash content is high, the quality of activated charcoal will be low because high ash content can reduce the heating value of activated charcoal.

Table 2. Result for ash level from banana peel active charcoal

Repetition	Ash level (%)
1	2,51
2	2,00
3	2,98

C. Iodine adsorption power

Iodine absorption is one of the important parameters in determining the quality of activated charcoal. The iodine test aims to determine the ability of activated charcoal to absorb molecules with small molecular weights and substances in the liquid phase. According to SNI-06-3730-1995, the minimum iodine absorption in active charcoal is 750 mg / g (BSN, 1995).

Based on the results of this study, iodine absorption obtained ranged from 1600-2050 mg / g (Table 3), so it can be said that the iodine absorption power is in accordance with the minimum limit on activated charcoal. High or low absorption of activated carbon to iodine solution shows that activated carbon has a greater surface area. The greater the absorption of iodine, the better the absorption of the activated charcoal.

Table 3. Result for iodine adsorption power from banana peel active charcoal

Repetition	Iodine adsorption power (mg/g)
1	2032
2	1651
3	1778

D. Permanganate value

Permanganate values indicate the number of milligrams of potassium permanganate needed to oxidize organic matter in 1L of water. The higher the permanganate value the higher the content of organic matter in a sample. Based on ANOVA results (Table 4), showed a significant difference (p> 0.05) in the treatment both contact time, concentration of activated charcoal, and interactions between contact time and concentration of activated charcoal

Table 4. ANOVA

Dependent Variable: hasil

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	423128,147[a]	23	18396,876	188,888	,000
Intercept	14329927,590	1	14329927,590	147130,981	,000
konsentrasi	387896,122	5	77579,224	796,536	,000
Waktu	9810,232	3	3270,077	33,575	,000
konsentrasi * waktu	25421,792	15	1694,786	17,401	,000
Error	4674,994	48	97,396		
Total	14757730,731	72			
Corrected Total	427803,141	71			

a. R Squared = ,989 (Adjusted R Squared = ,984)

Determination of the optimum contact time aims to determine the length of time required for activated charcoal to adsorb organic material to the maximum. Determination of the contact time is done with time variations of 5, 10, 15 and 20 minutes. In addition, the concentration of activated charcoal in adsorbing organic matter is also an important factor. In this study used active charcoal concentrations of 0, 0.01, 0.02, 0.03, 0.04 and 0.05 g/mL.

Based on the results obtained (Figure 1) the optimum contact time for activated charcoal is 20 minutes with a concentration of 0.02 g / mL. These results indicate that the longer contact time is given, the greater the adsorption power of activated charcoal to organic materials, but this does not apply to the concentration of activated charcoal used because the greater the concentration of activated charcoal does not cause the adsorption power of activated charcoal to be higher. Then it can be said that the lower permanganate test results, the better the adsorption power of activated charcoal will be on organic matter. High organic matter content will trigger the formation of carcinogenic compounds in the disinfection process and will be a medium for the growth of pathogenic microorganisms (Shorney, 1995 and Chang, 1998).

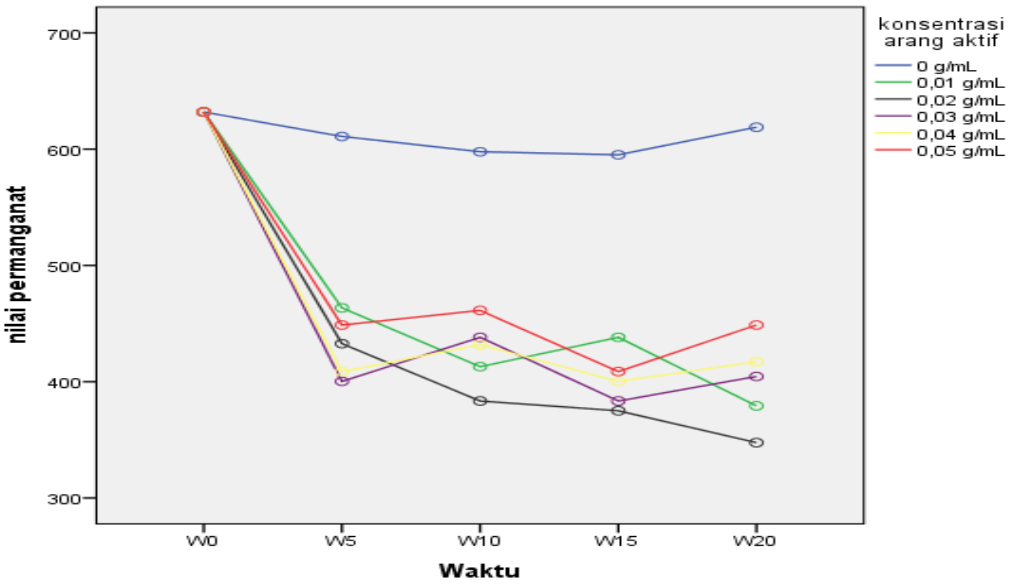


Figure 1. Graph for active charcoal in adsorbing the organic matters

IV. CONCLUSIONS AND RECOMMENDATION

Based on research that has been done, it can be concluded that:

1. The adsorbent dosage does affect the adsorption power of activated charcoal to organic matter.
2. Contact time has effect on the adsorption power of activated charcoal on organic matter.
3. The most optimal dose of adsorbent and contact time in reducing BOD value in organic matter is the contact time of 20 minutes and the adsorbent dose of 0.02 g/L.

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NUTRIENT CONTENT IN SUMATRAN ORANGUTAN DIETS (*Pongo abeli* Lesson, 1827) AT KETAMBE RESEARCH STATION, MOUNT LEUSER NATIONAL PARK, NANGGROE ACEH DARUSALAM

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Abstract

Orangutans eat a wide variety of dietary, while orangutans prefer to consume ripe fruit and when fruit is scarce they feed on leaves, inner-bark, flowers and other vegetation. However, we know little about the nutrition of foods consumed by Sumatran orangutans. We used proximate nutritional analyses to examine the nutritional composition of foods consumed by Sumatran orangutans in the area Ketambe Research Station, Sumatra. We found that total non-structural carbohydrates and total energy of non-fallback foods were higher relative to fallback foods, but lipids, protein, and neutral detergent fiber were higher for fallback foods. There is significantly different on water, protein, neutral detergent fiber and total non-structural betwen fallback foods and non-fallback foods. There was no significant trend that fallback foods contained more starch then non-fallback foods.

Keywords: orangutan foods, proximate analysis, energy, starch.

I. INTRODUCTION

Factors that influence the nutrient content in diet are vary widely according to Richard (1985). The nutrient content in the plant-based diet is influenced by the concentration of soil chemicals (nutrient supply), climate, and temperature; while the nutriet content in animal-based diet is influenced by the condition of the animal's body. Research on colobus diet which was conducted by Chapman et al. (2003) has shown that sunlight, soil chemical composition, plant phenology, and local microbial activity can significantly affect the nutrient content because high sunlight intensity can increase the nitrogen content in leaves. Furthermore, Hohmann et al. (2010) have conducted a nutrient content analysis in primate diets of the genus Pan in both high and lowland areas that have diverse rainfall. The diet samples which were obtained from lowlands have lower protein content and higher Total Nonstructural Carbohydrate (TNC) than those in the highlands.

Research on the nutrient content in the orangutan diet has been widely carried out in Kalimantan. Research on the nutrient content in fruits which are eaten by orangutans at Mount Palung National Park has shown higher TNC content than other nutrient components (Knott, 1998). van Schaik and Knott (2001) have done a nutrient content observation in *Neesia* sp. which is eaten oftenly by orangutan in Mount Palung. Fruit seeds of *Neesia* sp. contains 12.4% protein, 46% lipid, 9.9% Neutral Detergent Fruit (NDF), 31.7% TNC, and 590 kcal/ 100 g energy. Meanwhile, *Neesia* sp. pulp which are not eaten by orangutans contains 9.1% protein, 77.7% lipid, 7.4% NDF, 5.8% TNC, and 759 kcal/ 100 g energy. Hamilton and Galdikas (1994) examined the nutrient content in orangutan diets at Tanjung Putting National Park. There are two types of flowers which are eaten by orangutan i.e. *Dillenia* sp. and *Xanthophyllum* sp. both have higher Available Crude Protein (ACP) than the other diet categories (18.1% and 16.6%). The analysis results toward the mature leaves that were not eaten have shown that its water content, protein, and ACP are lower than the young leaves that were eaten by orangutan. Furthermore, the nutrient content analysis also showed that in general, the fruit contains low crude protein and ACP.

Analysis was carried out using the proximate analysis method to determine the nutrient content in the animal diet. This analysis can show the chemical composition in various forms based on the usefulness i.e. water, ash, crude fiber, lipid, and protein (Tillman et al.,1991; Prawirokusumo, 1994). This analysis method was also used by Knott (1999) at Mount Palung and Harrison (2009) at Sebangau. In addition, the NDF, TNC, and energy contents that can be generated from each component between the diet categories are also calculated.

Nutrient component that is more specific in animal diet and important to know as an energy source is starch (Harlan, 2006). Starch is a substance that must initially be converted into simpler molecules so that it can be used as an energy source. Starch is a carbohydrate derivative in polysaccharides; glucose polymer with alpha-1,4 and alpha-1,6 bonds; widely discovered in plant cells. Starch is small granules which has various sizes and shapes in each type of plant. The structure of the starch grains can be seen through a spectrophotometer which shows different colors for each type of plant (de Man, 1989).

II. RESEARCH METHODS

A. Equipment

Equipments that used to collect orangutan diet samples in the field are plastic bags, alumunium bowls, cutter blades, Hook oven, oil stove, electronic scales (accuracy = 0.01 g), plastic cliips, paper labels, calipers, and a calculator.

Nutrient content examination in orangutan diet samples by using the proximate analysis also requires some equipments i.e. blender, homogenizer, mortar grinder, scara (accuracy = 0.0001 g), porcelain cup, alumunium cup, oven, 600^{o}C furnace, desiccator, filter paper, Soxtex System HT 6 machine, extraction cup, sleeve, measuring cup, oil paper, digestion tube, Digestor 2020 and Kjeltec Auto Sampler System 1035 analyzer machine. Furthermore, equipments that required to check starch content in orangutan diets are scale (accuracy = 0.01 g), test tube, water bath, Vortex, pipette, centrifuge, Field-Portable Spectrophotometer (Ocean Optics; Dunedin, Florida) and laptop (Panasonic).

B. Material

Materials that used to collect orangutan diet samples in the field are tissue paper, kerosene, silica gel, and the diet samples themselves. Sample that will be used to perform both nutrient and starch analysis is appoximately 30 g in weight and has been dried from each part of the diets that are eaten by the orangutan. Furthermore, other additional materials that will be needed to carry out a proximate analysis in orangutan diet samples are 40 mL petroleum benzene, 2 K_2SO_4 tablets, 12 mL concentrated

H_2SO_4, 0.1 N HCl, 44% NaOH, 10 g boric acid, 10 mL brominecresol green, 7 mL red methyl, 1000 mL aquadestilata, 50 mL NDF reagent, and 0.5 g Na_2SO4. Also, chemicals from The Megazyme "Total Starch Assay Procedure" (K-TSTS 01/05; Wicklow, Ireland) Total Starch Kit are required to do the starch content analysis.

C. Procedures

Nutrient content examination in orangutan diet was carried out at the Nutrition Testing Laboratory, Biology Research Center-LIPI Cibinong. Meanwhile, the starch content examination was carried out at the Chemistry Laboratory, Universitas Nasional Jakarta.

a. Collection of Orangutan Diet Samples in the Field

Orangutan diet samples were obtained while following the orangutan. In addition, samples can also be taken directly from the orangutan eating tree. Fruit samples were collected based on ripe, half-ripe, and unripe categories. Dry Sample method (Knott, 1999) is the method used to dry the diet samples and the process is as follows:

a) Each diet sample should be recorded based on the name and the collected amount, particularly the overall diet weight i.e. the whole fruit or the whole flower.
b) Each diet sample is separated in parts, for example in fruit: husk, seeds, and pulp are separated. Then, each part that has been separated is weighed and recorded as wet weight.
c) Each sample is placed in an alumunium bown and labeled. Then, put it inside an oven with a temperature of 40-50^oC for 3-5 days.
d) When the sample is completely dry and the weight is constant, the sample is weighed again as in each part as dry weight.
e) The water content in the field from fresh samples is calculated by using this formula:

$$\text{Water content} = \frac{\text{wet weight - dry weight}}{\text{wet weight}} \times 100\ \%$$

f) Each sample part is inserted separately in a plastic clip and labeled. Then, includes one tablespoon of silica gel that has been wrapped.

b. Examination of Nutrient Content in Diet Samples

a) Diet sample preparation

All dried samples were placed in an oven at 60^oC to remove the dampness; 3 hours for leaves and 24 hours for fruits. Sample was mashed using a blender or homogenizer. Then, the sample was grinded in a mortar grinder for a few minutes in order to obtain smoother sample. The sample was filtered with a 60 mesh sieve so we have a powder sample.

b) Water, ash, lipid and protein content valuation base on SNI 01-2891-1992
d) NDF content was valuation

e) Total energy calculation in diet sample
Energy produced from the diet sample was calculated based on the Harrison (2009) method. This method used a derivative fraction i.e. 4 kcal/g (17 kJ/g) protein, 4 kcal/g TNC (16 kJ/g), and 9 kcal/g (37 kJ/g) lipid.
f) Starch content valuation
Starch content analysis can be performed by The Megazyme (2008) procedure. There are two stages working principle in this procedure. First, the starch will be dissolved and hydrolyzed. Then, the dextrin compound from starch was hydrolyzed into glucose using amyloglucosidase. This procedure will generate dissolved sample so that the starch small granules can be measured by the spectrophotometer. Starch contect was calculated based on the absorbance value of the spectrophotometer measurement.

D. Data Analysis

Both proximate and NDF analysis results were inputed in Microsoft Excel. Then, the energy content of each sample was calculated based on the formula from Harrison (2009). The absorbance values from the starch content analysis were also included in Microsoft Excel. Starch content calculations were carried out using Mega-Calc from The Megazyme (2008) based on the absorbance values obtained. Each diet sample was divided into two categories i.e. primary diet and alternative diet.

Subsequently, the data that have been compiled in Microsoft Excel were analyzed using non-parametric statistical tests to compare the nutrient content differences in each diet category. This non-parametric statistical test used was the Mann-Whitney U that can test the null hypothesis which the sample was drawn from the same population with a significance number of $P < 0.05$ or $P < 0.01$ (Siegel, 1997). Data analysis was performed by using SPSS for Windows.

III. RESULT AND DISCUSSION

A. Proximate Analysis

Diet samples that have been collected are 77 sampleswhich consist various categories i.e. fruit, seeds, flowers, young leaves, bark, and stem. Fruit is categorized as the primary diet, while seeds, flowers, young leaves, bark, and stem are categorized as the alternative diets (Figure 1.).

The highest water content was discovered in *Ficus* sp. fruit (13.53%), the highest ash content was in *Photos oxyphyllus* fruit (13.03%), the highest protein content was in *Erythrina subumbrans* young leaves (39.18%), the highest lipid content was in *Elatoostachys* sp. fruit (46.80%), the highest NDF content was discovered in *Alaeocarpus glaber* fruit (76.41%), and the highest TNC content was discovered in *Terminalia bellirica* (85.76%), while the highest total energy was discovered in *Durio zibethinus* fruit (140.49 kcal).

The average of water content, ash, TNC, and total energy from the primary diet are higher than the alternative diets, while the average of lipid content, protein, and NDF are higher in the alternative diets (Tabel 1.). These results are quite close and similar as the study in Tuanan, where the average of water content, TNC, and total energy were high in the primary diet, while ash, protein, lipid, and NDF content were high in the alternative diets (Zulfa et al.,2010).

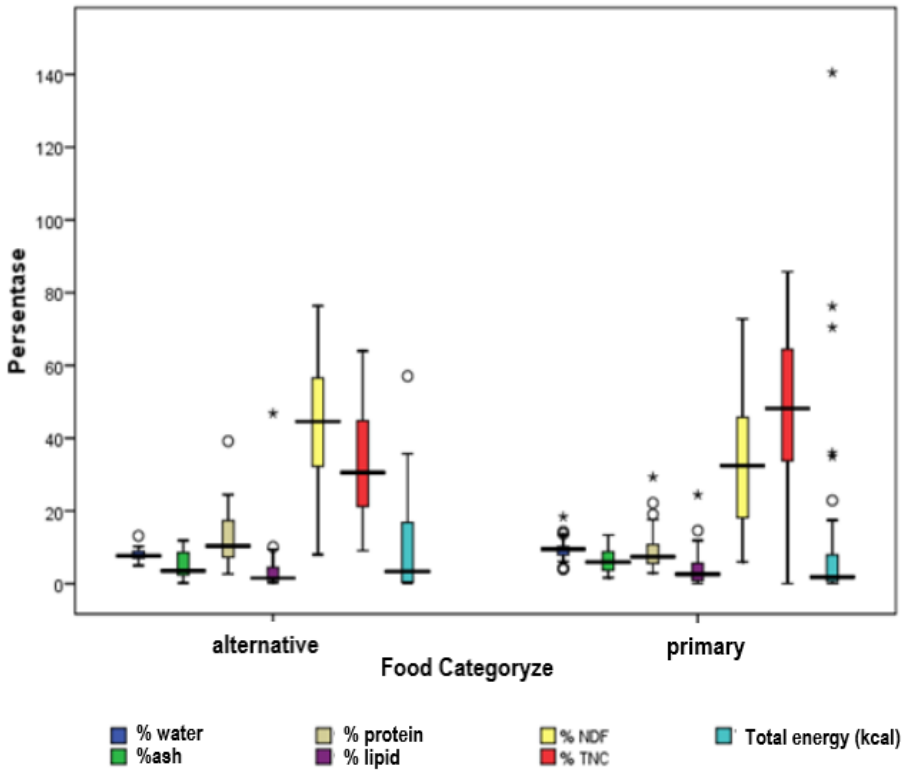

Figure 1. Proximate analysis result towards the orangutan primary and alternative diets.

The primary diet is a source of essential nutrients needed, while the alternative diets are a source of complementary nutrients. Fruit is the primary diet source that contains complete nutrients, but to fulfill other nutritional needs, orangutan must also consume the alternative diets, such as seeds, leaves, or vegetation. Meanwhile, to fulfill their carbohydrate and energy need, it is enough to eat fruit.

Table 1. The average of nutrient content percentage in orangutan diets

	N	Water	Ash	Protein	Lipid	NDF	TNC	Total Energy (kcal)
Primary diet	50	9,21	6,38	8,72	3,97	33,17	43,77	10,69
Alternative diet	27	7,96	5,24	12,81	4,49	43,86	33,60	10,46

The non-parametric Mann-Whitney U statistical test was performed to compare the difference in nutrient content between the primary diet and the alternative diet to compare the nutrient content difference between the primary diet and the alternative diet. The statistical test results showed that the differences in water content ($p = 0.006$), proten ($p = 0.027$), NDF ($p = 0.016$), and TNC ($p = 0.003$), while the ash content ($p = 0.066$), lipid ($p = 0.631$), and the total energy ($p = 0.790$) which determine that there is no significant difference. The test results are quite similar to those in Tuanan, which showed the differences in NDF and TNC content (Zulfa et al. 2010). Fruit generally contains high water content and TNC, while seeds generally contain lots protein and NDF (Almatsier, 2001).

2. Starch Analysis

Starch analysis was carried out on 51 diet samples which consist various categories i.e. fruit, seeds, flowers, young leaves, mature leaves, bark, stem, and tuber. As in the proximate analysis, the starch analysis is also divided into two categories, such as the primary diet category (N = 19) like fruit and the alternative diet category (N = 32) like seeds, flowers, young leaves, mature leaves, bark, stem, and pith. The highest starch content was discovered in *Antiaris toxicaria* bark (1.60 g/ l), while the lowest start content was discovered in *Loides* sp. flowers (0.17 g/ l).

The average value of starch content in the alternative diet was higher than the primary diet i.e. 0.53 g/L for the alternative diet and 0.44 g/L for the primary diet (Figure 2.). The high starch value in the alternative diet makes these diets difficult to digest, so they are rarely eaten (Hohmann et al. 2010). These results are consistent with the research from Cunningham et al. (2010) which states that orangutan chooses fruit as primary diet with low starch content. According to Almatsier (2001), alternative diets, particularly grains and tubers are the high source of starch.

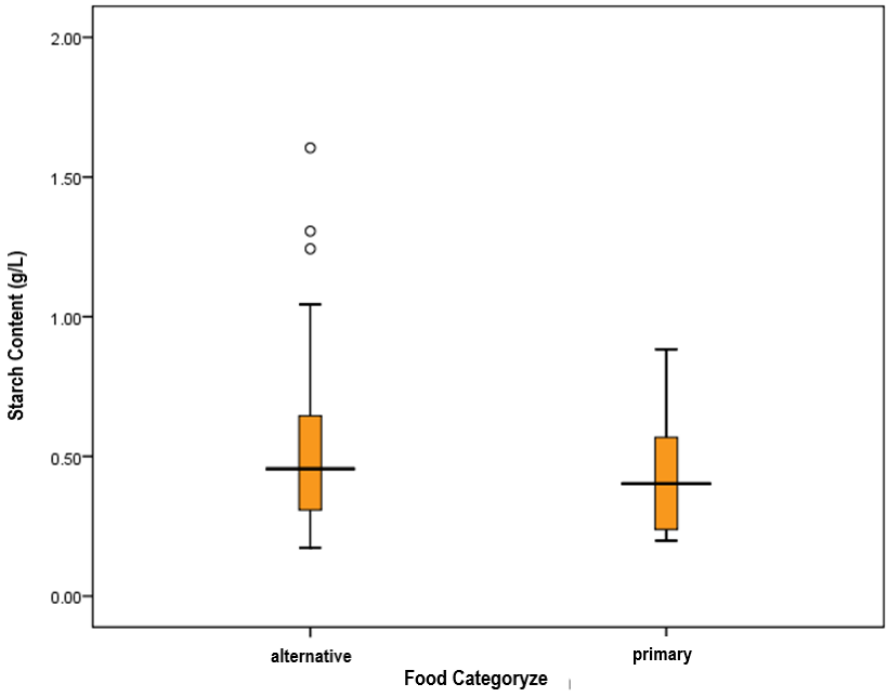

Figure 2. Starch content analysis result (g/L) towards the orang utan primary andalternative diets.

The Mann-Whitney U non-parametric statistical test compared the starch content between the primary and the alternative diets. The statistical tests results showed that there is no significant difference in starch content between the primary and alternative diets (p = 0.436). The difference in the average starch content in alternative diet is not big enough, so it cannot show the difference in starch content. According to Harlan (2006) the starch content in plants is influenced by several factors, including storage of starch in certain plant parts and the level of maturity. The results showed that the orangutan diets analyzed to value the starch content were ripe, half-ripe, and unripe. Many of the fruit and seed samples analyzed had a mature level of maturity.

IV. CONCLUSION

1. Water content, ash, TNC, and total average energy are high in the primary diet, while the lipid content, protein, and the average NDF are high in the alternative diet. There are also the water content, protein, NDF and TNC differences between the diets.
2. Starch content in the alternative diet has higher average number than the primary diet, but the difference seems insignificant between the diet categories.

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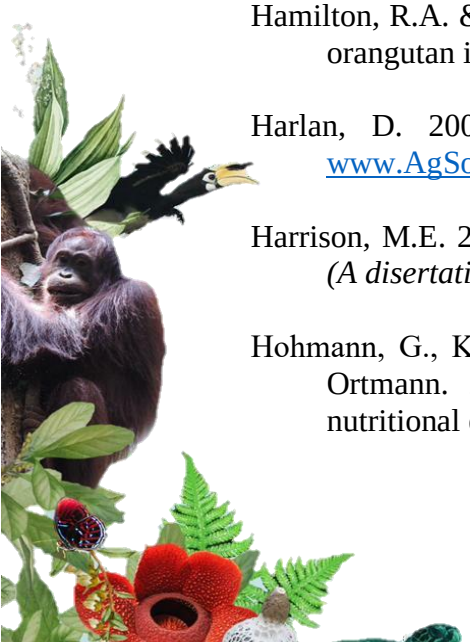

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HATCHING SUCCESS OF GREEN TURTLE (*Chelonia mydas*) IN SEMI-NATURAL HATCHERY CITIREM BEACH, CIKEPUH WILDLIFE RESERVE, SUKABUMI, WEST JAVA

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Abstract

The hunting threat of green turtles (*Chelonia mydas*) is not only for obtaining meat and shells, but also hunting for eggs, as well as by natural predators. Therefore an alternative is needed in conservation efforts in the form of a semi-natural hatchery program. This research was conducted with the aim of assessing the success of semi-natural hatchery of green turtle eggs in Citirem – Cikepuh Wildlife Reserve - Sukabumi - West Java - Indonesia. The results showed that the semi-natural hatchery incubated the eggs as many as 61 to 278 eggs per nest hole, the mean hatch success rate was 77.26% (between 50.59% and 93.06%). Spearmann's analysis showed that the correlation between the number of eggs incubated and eggs hatched was not significant (p = 0.14). This means that hatching success is not affected by the number of eggs incubated per nest hole. However; data shows that the number of eggs exceeds 200 per nest hole, hatching success has tended to decrease. Therefore; it is recommended that the maximum number of eggs per nest hole in the semi-natural hatching program is 200 and comes from one parent. Seeing this success; semi-natural hatchery programs are recommended to be developed in various areas, not only to avoid natural predators but also to avoidpoaching.

Keywords: Citirem, hatching succes, greenturtle, seminatural

Abstrak

Ancaman perburuanliar penyu hijau (*Chelonia mydas*) tidak hanya untuk memperoleh daging dan cangkang, tetapi juga perburuanliar terhadap telur, di samping oleh predator alami; oleh karena itu diperlukan alternatif dalam upaya konservasi berupa program penetasan semi-alami. Penelitian ini dilakukan dengan tujuan untuk menilai keberhasilan penetasan semi alami penyu hijau di Citirem – Suka Margasatwa Cikepuh - Jawa Barat. Hasil penelitian menunjukkan bahwa penetasan semi-alami dengan menginkubasi telur sebanyak 61 sampai 278 telur per lubang sarang, rata-rata keberhasilan penetasan adalah 77,26 % (berkisar antara 50,59 % dan 93,06 %). Analisis Spearmann menunjukkan bahwa korelasi antara jumlah telur diinkubasi dan telur menetas adalah tidak signifikan (p = 0,14). Ini memberi arti bahwa keberhasilan penetasan tidak dipengaruhi oleh jumlah telur yang diinkubasi per lubang sarang. Namun demikian; data memperlihatkan bahwa jumlah telur melebihi 200 per lubang sarang, keberhasilan penetasan sudah cenderung menurun. Oleh karena itu; disarankan jumlah telur per lubang sarang dalam program penetasan semi-alami maksimal adalah 200 butir dan berasal dari satu induk. Sehingga; program penetasan semi-alami disarankan untuk dikembangkan di berbagai kawasan, tidak hanya untuk menghindari predator alami tetapi juga untuk menghindari pemburuliar.

Kata Kunci : Citirem, keberhasilan penetasan, penyu-hijau, semi-alami

I. INTRODUCTION

Green turtle (*Chelonia mydas*) is one of the sea turtles with carapace sizes ranges between 71 cm and 153 cm. Green turtles can weigh up to 205 kilograms. Green turtles have flippers that function like oars, which are used for swimming. The head of the green turtle appears small in comparison to its body size. Male turtles are larger than female turtles and have a tail that is longer than their shell. Green turtles have carapace that is olive to brown in color, or sometimes black, depending on the geographic location of the species. There are two sub-species, that is *Chelonia mydas mydas* and *Chelonia mydas agassizii* (Ernst et al.,1994).

Green turtles can be found throughout tropical and subtropical marine areas around the world. These marine reptiles are capable of migrating long distances along the Hindian Ocean, Pacific Ocean and Southeast Asia. Green turtles emerge from the surface of the sea water and head for land when they are about to spawn. Only male turtles never move ashore during any phase of their life other than when they first hatch. When entering the breeding season, green turtles migrate across the ocean back to where they hatch. Female green turtles use the same beach for spawning activities as the place when they were hatched (Yusuf,2000).

Citirem Beach in the Cikepuh Wildlife Reserve in Sukabumi Regency - West Java - Indonesia with a coastline of ± 2 km is one of the natural locations for green turtle nesting grounds. In the Citirem Beach area, there is a semi-natural hatchery with a building of ± 80 m^2 with a roof in the form of asbestos. One of the conservation efforts carried out is by making egg relocation efforts. The relocation activity is carried out at night, then the eggs resulting from security are immediately planted in the hatchery with a depth of 80cm.

Green turtle is an endangered species due to various problems. One of the reasons is that the intensity of predators is not balanced with the reproduction of turtles that do not spawn every year. Although the female can lay up to 200 eggs in a single nest, some will not hatch, and many will be eaten by predators. Even when the eggs hatch, the hatchlings are eaten on their way to the sea. So only a few hatchlings can survive to adulthood. Green turtles can survive to be more than 100 years old. In addition, the existence of sea turtles is also threatened by human activities that directly or indirectly endanger the population.

Green turtle (*Chelonia mydas*) is a sea turtle with high economic value which is widely used by the community (Segara, 2008). Hunting is carried out to get the meat for consumption for the community, or for sale in the market, and the skin (shell) is used as decoration. In fact, green turtles are a protected species in Indonesia (P. 106 / MENLHK / SETJEN / KUM.1 / 12/2018), even since 1999 (PP No.7 / 1999); and has been classified as an endangered wildlife according to the IUCN since 2004, and is one of the species listed in the CITES appendixI.

Hunting for green turtles does not only happen in Indonesia; but in various countries in the world such as in Costa Rica (Troeng et al, 2005). The threat to the sustainability of green turtles is not only poaching for meat and shells; but also egg hunting (Djohan, 2004); whereas natural threats are predators, relatively varying between locations (Gyuris, 1994). Predation generally occurs against eggs in the nest and to hatchlings (chicks) that have justhatched.

In the effort to conserve green turtles, semi-natural hatchery programs are the main alternative to avoid hunting for eggs and natural predators. However; the success of semi-natural hatchery at Citirem has never been published. Has the semi-natural hatching program worked well? That's why this research was conducted, aimed at assessing the success rate of hatching green turtle eggs (*Chelonia mydas*) at Citirem Beach - Indonesia. The hypothesis proposed in this study is that there is a correlation between the number of eggs incubated and hatchingsuccess.

II. RESEARCH METHODS

This research was conducted at Citirem Beach – Cikepuh Wildlife Reserve - Sukabumi Regency - West Java Province, Indonesia. The data analyzed in this manuscript is the hatching data of green turtles that were hatched in the semi-alami hatchery program from 2012 to 2019.

Egg collection is carried out at night by monitoring the presence of green turtles (*Chelonia mydas*) which determines the Citirem coastal area for nesting eggs. Researchers let the turtles finish nesting and backfill the nest with sand. Egg retrieval is carried out after the turtle leaves the nest to return to the sea. All eggs are removed by carefully placing them in a plastic wrap bag, and brought to the location of the Semi-naturalHatchery.

All eggs are placed into a nest (artificial hole) with a depth of about 70 cm to 80 cm, and filled with sand. The semi-natural hatchery area, which is surrounded by a fence, is guarded by special officers, for protection from predatory animals and humans. The environmental conditions of semi-natural hatcheries have a temperature of around 27^0C-30^0C and will not be flooded by sea water in high tideconditions.

Each nest in the semi-natural hatchery contains a number of eggs that vary with age not uniformly, depending on the time of discovery of the turtle nesting and the number of eggs obtained. Therefore, hatching times are also not uniform between nests; so that the data used and analyzed in this manuscript come from several hatching periods.

The parameters determined to assess the success rate of hatching green turtle eggs in semi-natural nests were the number of eggs incubated and the number of eggs hatched. The hatch success rate is calculated using the following equation:

$$\text{Hatching succes (\%)} = \frac{\text{number of eggs hatched}}{\text{number of eggs incubated}} \times 100$$

Data correlation analysis between the number of eggs incubated and hatching success was carried out at the Faculty of Biology, National University, South Jakarta using the Spearman Correlation Test and using SPSS software as a supporting application.

III. RESULTS AND DISCUSSION

Over several periods; the number of green turtle eggs obtained and incubated in the Citirem Semi-natural Hatchery area ranged between 61 and 278 eggs. Each nest of eggs hatches between 42 and 176. In general; the more eggs are incubated, the more eggs will hatch into hatchlings (young turtles) (Fig. 1), but in this study not all eggs hatched. Semi-natural nest holes that contain a relatively large number of eggs, possibly not only one parent; but from 2 or more broods gathered on the same night. The results of research by Nastiti at al (2017) in Pangumbahan - Sukabumi - West Java (close to Cikongga), from 39 individuals who lay eggs, the number of eggs was 80-105 per parent. Likewise, Sheavtiyan at al (2014) based on the results of their research at Sebubus Beach - Sambas - West Kalimantan - Indonesia, that the average number of eggs found in one natural nest hole is 90eggs.

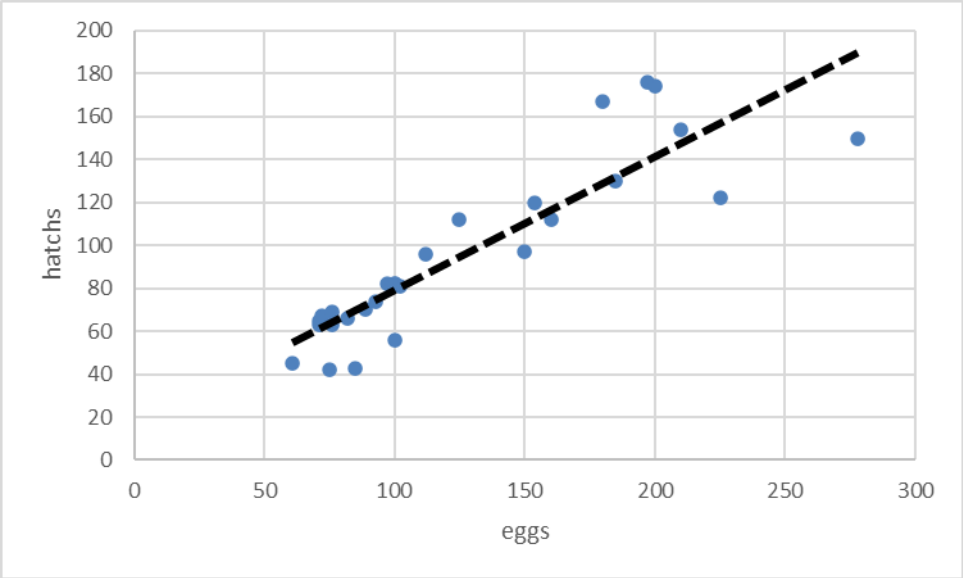

Fig 1. Variation in the number of eggs incubated and the number of eggs hatched, in green turtles in each semi-natural hatchery, Citirem - West Java - Indonesi

Failure to hatch eggs can occur due to a variety of causes, primarily by the temperature of the nest, the number of eggs incubated in the nest, or the time interval for transferring eggs from their natural nest to a semi-natural hatchery. Yusuf (2000) explains that good temperatures during the incubation period are between 24^0C and 33^0C; temperature that is too low (< 24^0C) has an impact on embryo development so that it requires a longer incubation time, whereas if it is too high (> 33^0C) it can cause the death of hatchlings. In this study, the temperature in the semi-natural hatchery area of Citirem means that it is still in the optimal range, which is between 27^0C and 30^0C. On another occasion, Souza et al (2008) explained that the success of hatching green turtle eggs in their research in Brazil was also influenced by the concentration ofCu.

The addition of the number of eggs incubated in this study will also increase the number of hatched eggs (hatchlings). Hatching success ranged from 50.59% (of the 85 incubated eggs) and 93.06% (of the 72 incubated eggs); the hatchery success rate was 77.26%. The success of this hatchery is relatively the same as in natural nests; such as the results of research by Sheavtiyan at el (2014) in Sebubus Beach - West Kalimantan - Indonesia, that the highest hatching success also reached93.13%.

These data in this studi show that the lowest hatching success occurs not in holes with few or many eggs; likewise, the highest hatching success, not in holes with a few or a large number of incubated eggs. The results of Rank Spearman analysis showed that the correlation between the number of eggs incubated and hatching success was not significant (p = 0.14). This result means that hatching success is not related to the number of eggs incubated, in the area of Semi-natural Hatchery Nest -Citirem.

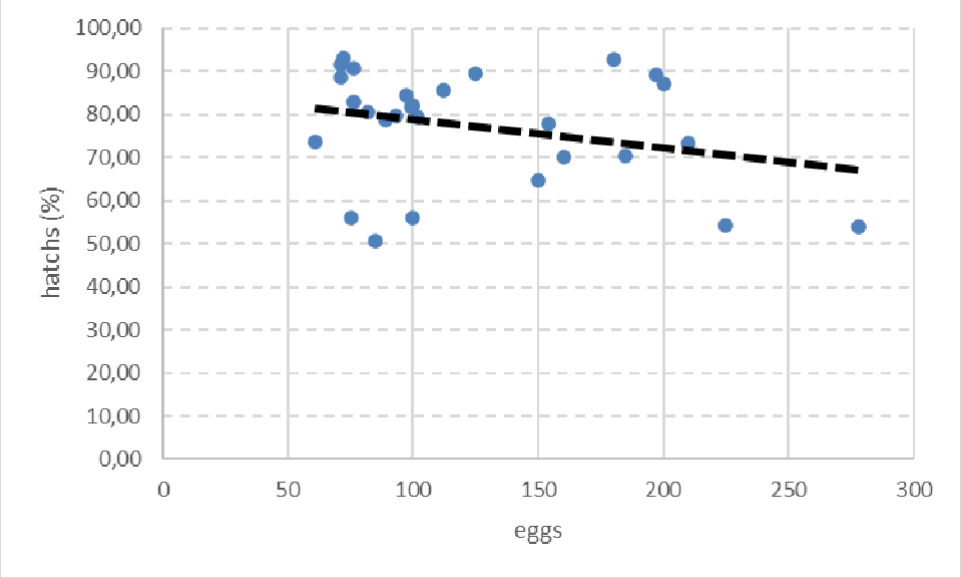

Fig 2. Hatching success based on the number of eggs incubated, in green turtles in each semi-natural hatchery, Citirem - West Java - Indonesia

The number of eggs can affect the success of turtle egg hatching. Nests with a total of 50 turtle eggs have a better hatching success than nests with 75 and 100 eggs (Silalahi, 1989). In this study, this is not the case; Spearmann's analysis proved the correlation was not significant. However, there was a tendency that hatching success tended to decrease as more eggs were incubated (Fig. 2). Nest holes with low hatching success can occur due to (1) too long the process of moving eggs from the natural nest hole to the artificial (semi-natural) nest hole, (2) the eggs incubating in one nest hole, coming from 2 parents or more, (3) too many eggs incubated in one nest hole (> 200 eggs).

IV. CONCLUSION AND RECOMMENDATION

Based on the results of the research that has been done, it can be concluded that the success of the semi-natural hatchery program of green turtle eggs in Citirem - Cikepuh Wildlife Reserve has been good with 77.26% hatchery success. Programs like this are recommended to be implemented in various locations as the main alternative to turtle conservation programs to avoid natural predators and hunting. Egg transfer should be carried out as soon as possible, and each nest hole filled with ≤ 200 eggs from onebrood.

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UTILIZING OF KEPOK BANANA PEEL ACTIVE CHARCOAL AS ADSORBENT TO REDUCE IRON CONTENT IN GROUND WATER

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Abstract

Water usage for daily purposes, up to now besides sourced from PDAM in general, it also sourced from the ground water. The problem that arise when using ground is the mineral components, especially iron. Iron (Fe) is one of the elements that can be encountered in almost everywhere on earth, all geological layers and all bodies of water. In general, the presence of iron in the water can be dissolved. In the Permenkes RI: No. 416 of 1990 and No. 492 of 2010 about water quality requirements, one of the regulated parameters is a maximum iron content of 0.3 mg/ L. Iron content that exceed the threshold will have an impact on health and cause the water aesthetic problems. One of the methods to decrease iron level is by utilizing kepok banana peel active charcoal as an adsorbent. The aims of this research is to determine the dosage and the most optimum adsorbent contact time to decrease iron content in ground water. The type of this research is experiment with one group pre-post-tests design conducted by batch adsorption system with variation of adsorbent dose (0, 20, 30, 40 and 50 g/ L) and variation of contact time (0, 30, 60, 90 and 120 minutes) in ground water. The research begins with the of adsorbent which is kepok banana peel active charcoal, retrieval and preservation of ground water samples, ground water characteristics testing, batch adsorption process and data processing. Analysis of iron content is conducted by using spectrophotometric method. The obtained data were analyzed by using software with one way ANOVA program Statistical Product and Service Solution (SPSS) 22.0. Tukey HSD Test (BNJ) in level 5% used in this research to know the effect of treatment level. The result showed that the adsorbent dose and contact time did not affect the adsorption capacity of activated charcoal against Fe. The most optimal dose of adsorbent and contact time in reducing Fe level in solution was 90 minutes contact time and 30 g/ L adsorbent dose.

Keywords: Active Charcoal, Adsorbent, Kepok banana

I. INTRODUCTION

Iron (Fe) is often a problem in the supply of water for household needs, especially if the source comes from ground water. In the soil, iron (Fe) is difficult to dissolve. Besides the unpleasant appearance, the high water content of the iron has an unpleasant taste. Basically iron in water in the form of Ferro (Fe^{2+}) or Ferri (Fe^{3+}). This depends on the condition of the pH and oxygen dissolved in water. At neutral pH and the presence of sufficient dissolved oxygen, the dissolved ferrous ion can be oxidized to ferric ions and subsequently form a precipitate. Ferric hydroxide which is difficult to dissolve, in the form of precipitate which is usually brownish yellow.

The concentration of dissolved iron obtained in clean water is up to 0.3 mg / L. Iron comes mostly from its contact with soil and rock formation. In general, iron content in iron comes from areas where the topsoil is rather thick. The iron content in drinking water can be dissolved as Fe^{2+} or Fe^{3+} suspended as colodial grains or larger such as FeO, and which is combined with organic or inorganic substances.One method

used to treat domestic waste is the adsorption method. Adsorption is considered the best method for treating wastewater because of the low cost and ease of operation (Ali *et al*. 2012).

Various types of materials can be used as adsorbents such as alumina, silica, zeolite and activated charcoal. According to Gupta *et al.* (2009) activated charcoal is the type of adsorbent that is most often used because the process of adsorption of activated charcoal is very useful and effective in purifying waste because it can remove organic pollutants from water. Activated charcoal can be made from various types of carbon-containing materials such as new stones, coconut shells, coconut shells, palm oil, rice husks, sawdust and others(Ali *et al*. 2012).

In this research, the material chosen as the raw material for activated charcoal is Kepok banana peel. The choice of banana peel as an active ingredient of charcoal is because banana peel is generally only used as food for livestock such as goats, cows and buffalo. Even in some areas they are still left as waste. One type of banana that is widely used by the community is the kepok.According to Hewwet et al. (2011) in Endra (2013), kepok banana peel (*Musa acuminate balbisiana*Colla) contains various biochemical components that allow banana peel waste to be used as an ingredient for making activated charcoal.

Activated charcoal is activated charcoal so that it has a fairly high adsorption power. Activated charcoal is crystallite consisting mostly of free carbon and has a large inner surface area, so it has good adsorption power. According to Othmer (1992) in Adinata (2013), activated charcoal is a porous substance containing 85 - 95% carbon, produced from materials containing carbon with high temperature heating so that a large surface area is obtained, ranging between 300 - 2000 m^2/g.a.

Adsorbent dosage and contact time of the kepok banana peel active charcoal to reduce the iron levels in the ground water have not been known yet and the adsorption mechanism of the active charcoal itself still remains unknown too. The aims of this research is to determine the dosage and the most optimum adsorbent contact time to reduce the iron levels (Fe) in the ground water.

This research is expected to give information about the advantages of utilizing kepok banana peel active charcoal as an adsorbent to reduce the iron content (Fe) in the ground water. The submitted hypothesis in the research are:

3. Active charcoal dosage will affect the decrease of the iron levels (Fe) in the ground water.
4. Contact time of the active charcoal will affect the decrease of the iron levels (Fe) in the ground water.
5. The interaction between the dosage and the contact time of the active charcoal will affect the decrease of the iron levels (Fe) in the ground water.

II. RESEARCH METHODS

A. Time and research location

This research was conducted in 1 (one) even semester of 2017/2018 academic year at Chemistry Laboratory, Laboratory Center of Universitas Nasional, Jl. Bambu Kuning, Ps. Minggu, South Jakarta.

B. Tools and materials

1. Tools

A set of glassware, furnace, oven, blender, digital scale, shaker, 100 mesh strainer, porcelain plate, spectrophotometer, Spectronic 20 Bausch-Lamb.

2. Materials

Kepok banana peel (*Musa balbisiana*C.), concentrated-sulfate acid and ferro sulfate.

C. Working procedures

1. Adsorbent making

Adsorbent that is used in this research is active carbon from kepok banana peel waste. Steps to make the active carbon are as follows:

a. Kepok banana peels are cut to 1 – 2 cm, then washed with the water until it is clean. After that, banana peels are dried or roasted until it is dry.

b. Furthermore, banana peel is carbonized until it is turned into charcoal in a furnace at a temperature of 400 degrees Celsius. During the process, the furnace is kept closed so that no incoming oxygen prevents ignition.

c. Banana peel charcoal is then ground and blended first, and sieved using a 100 mess strainer. The sifting process aims to obtain uniform sizes of activated charcoal.

d. Banana peel charcoal powder is activated with H_2SO_4 5% in 24 hours.

e. Activated banana skin charcoal is then filtered with filter paper and washed with hot water which is useful for removing impurities present in banana peel charcoal powder during soaking.

f. Clumps of activated charcoal powder of banana peels obtained, dried repeatedly in the oven at a temperature of 105 degrees Celsius aims to reduce the water content in the activated charcoal of banana peels. Refined and sieved with a size of 100 mesh. Ready to be used for adsorbing.

2. Artificial waste samples taking and preserving

Waste that was used in this research is considered as artificial waste, with $FeSO_4$ levels in the initial treatment (P_0) of 500 ppm. Water characteristics that were tested, involving iron parameter (Fe) using spectrophotometric method.

3. Batch adsorption process

Batch adsorption process was conducted at laboratory at room temperature of ± 25 degrees Celsius. In the experiment, a 250 mL Erlenmeyer flask was prepared. Next in each container 100 mL groundwater samples were added, then the activated charcoal adsorbent of kepok banana peel with various dosages of adsorbent 20, 30, 40 and 5 g / L. Then the bottles were arranged on a shaker and stirred at a speed of 150 rpm with variations in contact time 30, 60, 90 and 120 minutes. Then re-measuring Fe content.

4. Data analysis

Data processing of measurement results is performed by mathematical calculations as follows:

$$\text{The decrease of Fe } (\%) = \frac{(\text{Co} - \text{Ce})}{\text{Co}} \text{ x } 100\%$$

Co = initial Fe levels (%)
Ce = Fe levels after the adsorption (mg/ L)

D. Research plan

This research used a Factorial Complete Randomized Design (RAL Factorial) with 2 factors which are: the dose of adsorbent (0, 20, 30, 40 and 50 g / L) and contact time (0, 30, 60, 90 and 120 minutes). Each treatment was repeated 3 times. The total number of experimental units is 75 trial units.

The obtained data were analyzed by using software with one way ANOVA program Statistical Product and Service Solution (SPSS) 22.0. Tukey HSD Test (BNJ) in level 5% used in this research to know the effect of treatment level.

III. RESULTS AND DISCUSSIONS

A. Contact time

The adsorption power of kepok banana peel active charcoal with variations in contact time (30 minutes, 60 minutes, 90 minutes and 120 minutes) is presented in Table 1 and Figure 1. Contact time of 120 minutes tends to provide high adsorption results compared to other contact time treatment levels (34,448% ± 10,912%). At contact time of 60 minutes to 90 minutes, the effectiveness of adsorption had decreased, but the addition of contact time to 120 minutes again increased the effectiveness of activated carbon.

The results of analysis of variance in Attachment Tabel 1 show that the contact time had no significant effect ($p < 0.05$) on the adsorption of $FeSO_4$ solution. This can be caused by the too close contact time span used in this study so that the adsorption ability does not look significant.

Table 1. Result for active charcoal contact time variation against $FeSO_4$ solution.

Contact time (minutes)	Adsorption power of FeSO4 solution Mean ± Deviation Standard (%)
30	33,788 ±9,047
60	29,166 ±3,420
90	28,624 ±10,907
120	34,448 ±10,912

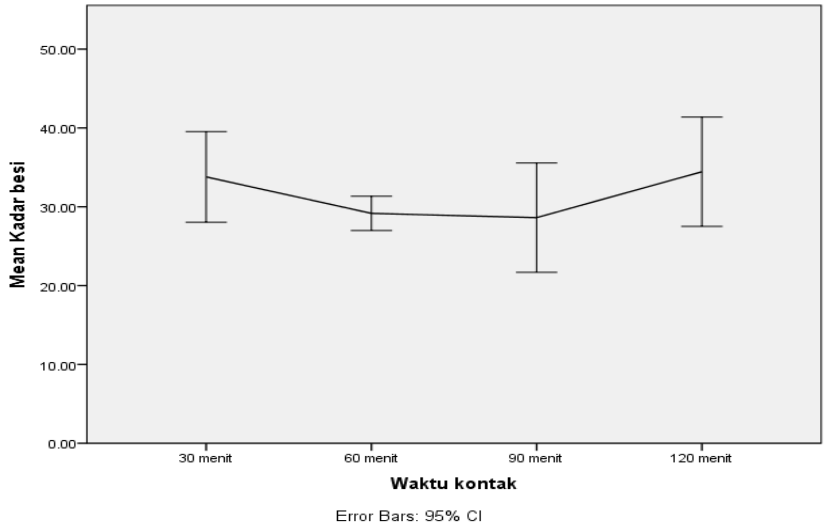

Figure 1. Diagram for active charcoal contact time variation against $FeSO_4$ solution

B. Adsorbent dosage

Adsorption power of activated charcoal from kepok banana peel with various adsorbent dosages (20 g / L, 30 g / L, 40 g / L, 50 g / L) are presented in Table 2 and Figure 2. A dose of 30 g / L tends to give an adsorption result higher than the level of treatment of other adsorbent doses (35,475 ± 9,292%). At a dose of 40 g / L, the adsorption power of the adsorbent begins to decrease.

Table 2. Result for active charcoal adsorption power variation against FeSO4 solution.

Active charcoal dosage (g/L)	**Adsorption power of $FeSO_4$ solution Mean ± Deviation Standard(%)**
20	33,475 ± 6,512
30	35,383 ± 9,292
40	31,118 ± 7,170
50	26,049 ± 11,328

The decrease in adsorption power is probably caused by the existence of partial aggregation, which is the formation of aggregates in the adsorbent (Fajrianti*et al*. 2016). The metal removal efficiency can be reduced by increasing the adsorbent dose due to the partial aggregation of the active adsorbent portion (Hossain *et al*. 2012).

Based on the analysis of variance in Attachment Table 1 shows that the dose of adsorbent had no significant effect ($p < 0.05$) on the adsorption of FeSO4 solution. This can be caused by the close range of doses used in this study so that the adsorption ability does not look significant.

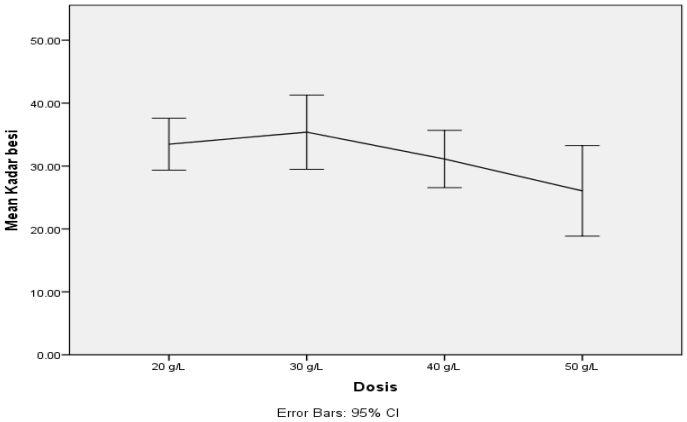

Figure 2. Diagram for active charcoal adsorption dosage variation against $FeSO_4$ Solution.

C. Interaction between contact time and adsorbent dosage

Adsorption power of the kepok banana peel active charcoal with the interaction between the variation of contact time (30 minutes, 60 minutes, 90 minutes and 120 minutes) and adsorbent dosage (20 g/L, 30 g/L, 40 g/L, 50 g/L) is showed on Table 3 and Figure 3. A dose of 30 g/L in 90 minutes tends to give adsorption result that is higher than other dosages (40,651 ± 7,157%).

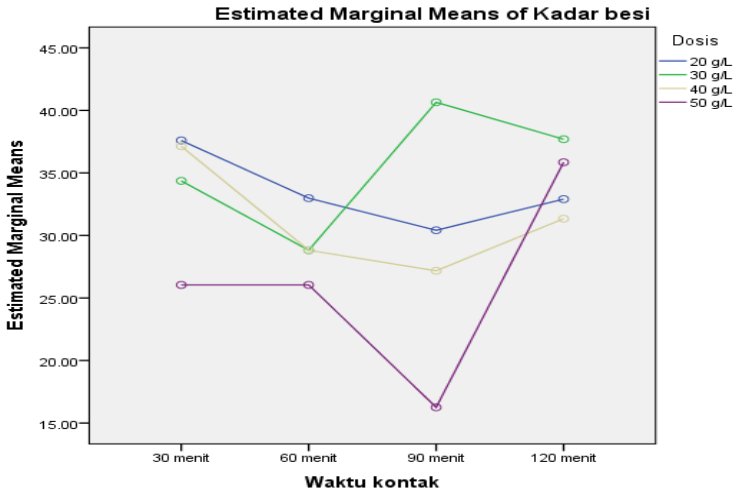

Figure 3. Diagram for active charcoal adsorption contact time and dosage variation against $FeSO_4$ solution

Table 3. Result for active charcoal contact time variation against FeSO4 solution.

Contact time (minute)	Active charcoal dosage (g/L)	Adsorption power of $FeSO_4$ solution Mean ± Deviation Standard (%)
30	20	37,601 ± 6,043
	30	34,366 ± 10,499
	40	37,139 ± 8,006
	50	26,045 ± 10,500
60	20	32,979 ± 2,119
	30	28,819 ± 1,600
	40	28,819 ± 1,600
	50	26,046 ± 4,235
90	20	30,416 ± 8,854
	30	40,651 ± 7,157
	40	27,174 ± 6,710
	50	16,254 ± 5,016
120	20	32,904 ± 8,567
	30	37,696 ± 13,963
	40	31,339 ± 9,238
	50	35,851 ± 16,259

Based on the analysis of variance in Attachment Table 1 shows that the interaction between contact time and adsorbent dosage had no significant effect ($p < 0.05$) on the adsorption of $FeSO_4$ solution.

IV. CONCLUSION AND RECOMMENDATION

Based on research that has been done, it can be concluded that:

1. The adsorbent dosage does not affect the adsorption power of activated charcoal to Fe metal.
2. Contact time has no effect on the adsorption power of activated charcoal on Fe metal.
3. The most optimal dose of adsorbent and contact time in reducing Fe levels in solution is the contact time of 90 minutes and the adsorbent dose of 30 g / L.

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