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Research Article

Study of Primate Diversity at the Botanical Garden in Pahlawan Tuanku Tambusai University

Studi Keragaman Primata di Kebun Raya Universitas Pahlawan Tuanku Tambusai

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Abstract: Pahlawan Tuanku Tambusai University has a Botanical Garden with an area of 152 Ha with an area of Zone A (27 Ha) and Zone B (125 Ha). The Botanical Garden of Universitas Pahlawan is a habitat for various types of Fauna one of the animals in the Botanical Garden is Primates. This study aims to analyze the diversity of primates in Zone A at the Botanical Garden of Universitas Pahlawan from Kampar, Riau. The research method uses the transect path method by walking along the transect line. Primate research studies in the Botanical Garden area, especially in Zone A, there are three types of primates, namely *Macaca fascularis, Presbytis thomasi* and *Macaca nemestrina*. Based on field observations, Presbytis thomasi is the dominant primate, with a count of 14, followed by Macaca fascicularis with a total of 10, and *Macaca nemestrina* with a total of 2. Primate diversity in the Pahlawan University Botanical Garden remains relatively low, ranging from 0.14 to 0.52, and the dominance index varies from 0.08 to 0.54. The dominant primate is the Kedih (*Presbytis thomasi*) with a dominance index 0.5. The distribution of the three primates is still in the secondary forest area and part of the rubber and oil palm plantation area of the Pahlawan University Botanical Gardens.

Keywords: Botanical Garden, Habitat, Primate, Conservation, Pahlawan University

Abstrak: Universitas Pahlawan Tuanku Tambusai memiliki Kebun Raya dengan luas kawasan 152 Ha dengan luasan Zona A (27 Ha) dan Zona B (152 Ha). Kebun Raya Universitas Pahlawan merupakan habitat bagi berbagai jenis Fauna salah satu satwa yang ada di Kebun Raya tersebut adalah Primata. Penelitian ini bertujuan untuk menganalisis keanekaragaman primata di Zona A di Kebun Raya Universitas Pahlawan asal Kampar, Riau. Metode penelitian menggunakan metode jalur transek dengan cara berjalan kaki menyusuri garis transek. Penelitian primata di kawasan Kebun Raya khususnya di Zona A terdapat tiga jenis primata yaitu *Macaca fascularis*, *Presbytis thomasi* dan *Macaca nemestrina*. Berdasarkan hasil pengamatan di lapangan, *Presbytis thomasi* merupakan primata yang dominan dengan jumlah 14 ekor, disusul oleh *Macaca fascicularis* dengan jumlah 10 ekor, dan *Macaca nemestrina* dengan jumlah 2 ekor. Keanekaragaman primata di Kebun Raya Universitas Pahlawan masih tergolong rendah yaitu berkisar antara 0,14 sampai dengan 0,52 dan indeks dominansinya bervariasi antara 0,08 sampai dengan 0,54. Primata yang dominan adalah Kedih (*Presbytis thomasi*) dengan indeks dominasi 0,5. Persebaran ketiga primata tersebut masih pada kawasan hutan sekunder dan sebagian areal perkebunan karet dan kelapa sawit Kebun Raya Universitas Pahlawan.

Kata kunci: Kebun Raya, Habitat, Primata, Konservasi, Universitas Pahlawan

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INTRODUCTION

Nature conservation is one of the conservation efforts in maintaining biodiversity. The government has issued PERPRES No. 83 (2023) concerning Botanical Gardens as ex situ plant conservation areas that have documented plant collections and are arranged based on taxonomic, bioregional, thematic classification patterns, or a combination of these patterns for the purpose of conservation activities, research, education, tourism and environmental services. The Indonesian Botanical Garden (IBG) has an international role in implementing the Global Strategy for Plant Conservation (GSPC), this is stated in 16 targets of world plant rescue (Davis, 2008).

Pahlawan University and The National Research and Innovation Agency (Indonesian: Badan Riset dan Inovasi Nasional, BRIN) have designated the Pahlawan University Botanical Garden as a Conservation area. Conservation is an effort made by humans to preserve or protect nature. Conservation of natural biological resources in Indonesia is carried out in three principles, namely: protection, preservation and sustainable use, and is realized in the form of in-situ and ex-situ conservation area programs (Irwanto 2023). The Pahlawan University Botanical Garden as a conservation area in the Pahlawan University area and its surroundings will have many benefits including as a habitat for various types of plants and animals.

Botanical gardens are one of the habitats for animals such as Primates, where long-tailed monkeys are one of the forest-dwelling animals that have an important meaning in life in nature. Long-tailed monkeys in their habitat have an ecological function as sowing fruit plant seeds which are important for plant conservation. Long-tailed macaques consume stems, young and old leaves, seeds, grass, mushrooms and insects as a source of energy (Wheatley, 1980; Yeager, 1996). Seponada and Firman (2010) stated that long-tailed macaques function as insect population controllers by eating.

The diversity of primate species in the Botanical Garden has never been revealed, so this is very important to do research as initial data on primate diversity in the Botanical Garden area. In addition, with these data, it will add to the special collection data at the Pahlawan University Botanical Garden. The Pahlawan University has a Botanical Garden with an area of ± 152 Ha with Zone A (27 Ha) and Zone B 125 (Ha). This study aims to analyze the diversity of primates in zone A of the Pahlawan University Botanical Gardens.

MATERIALS AND METHODS

This research was conducted February to July 2024. Samples were taken at one locations on Block A (0˚19'6.70"N; 101˚ 2'6.40"E) Botanical garden University Pahlawan, Riau Province (Figure 1). Current research focuses on the area in zone A of the Botanical Garden with the following boundaries:Northside bordering Candika Hill, ast side bordering Ring Road, Southside bordering Pahlawan University, and West side bordering Tuanku Tambusai Street.

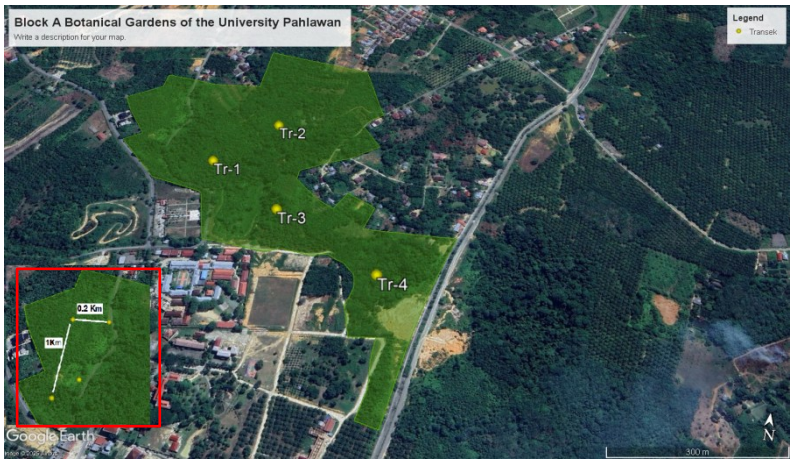

Figure 1. Study sites in Block A Botanical Garden, University Pahlawan. The inset shows an overview of the spatial configuration of point count locations within each survey transect. (Source: Google earth 2025)

Data Collection Method

The research uses the path transect method by walking along the transect line (Bismark, 2011). Observation of the path along 1 km with unlimited width, the starting point of observation starts from the boundary of the area.

An illustration of the observation method can be seen in Figure 2.

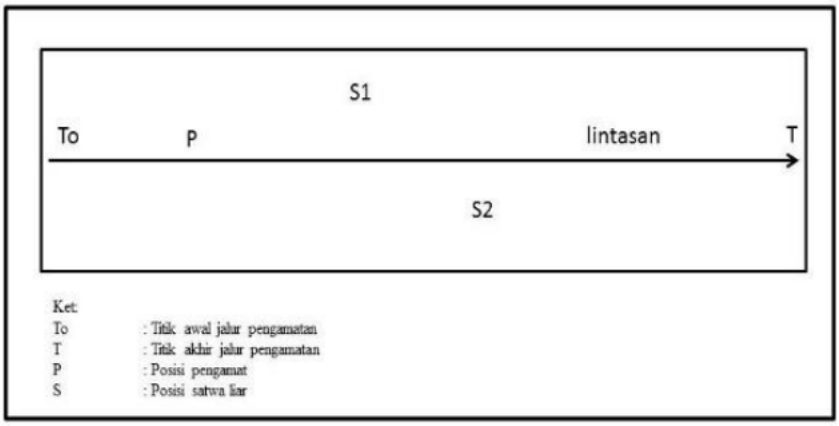

Figure 2. Illustration of the transect line observation method

Primary data and environmental parameter data as the main data in the study. Primary data is data obtained directly from the field in the form of primate species, the number of individuals of each species, and the type of primate activity, while environmental parameter data is in the form of general conditions of the research location (forest type, coordinate points, altitude, humidity, and temperature). The data collection process in each research route was carried out in the morning at 07.00-11.00 and in the afternoon at 14.00-17.00. The collection time

was adjusted to the primate activity because primates forage and interact in the morning and evening while during the day primates rest more (Ario et al., 2019). Observation data of objects found were recorded on a tally sheet. Objects were also photographed to facilitate the identification process.

Identification guide in the field using a special Identification book for Wild Animals and assistance from PPKAB officers. The data obtained were then analyzed using biological indices consisting of the Shannon Wienner diversity index (H'), the Evenness evenness index (E), and the Dominance of Simpson dominance index (C).

A. Shannon-Wiener Diversity Index.

The primate diversity index can use the Shannon-Wiener index (Soerianegara and Indrawan 2002) to find out with the formula:

$$H' = -\sum_{i=1}^{s}\left[\left(\frac{ni}{N}\right) ln\left(\frac{ni}{N}\right)\right]$$

H' = where Pi = (ni/N).
Description: H' = Shannon-Wiener species diversity index
ni = Number of individuals of species (i).
N = Number of individuals of all species.
The diversity index criteria according to Shannon-Wiener are as follows: H' < 1 = Low level of species diversity 1< H' < 3 = Medium level of species diversity H' > 3 = High level of species diversity.

B. Dominance Index

Dominance Index is one of the metrics used in ecology to measure the level of dominance of a particular species in an ecological community. This index helps researchers understand how evenly or unevenly distributed individuals are among the species present in an ecosystem. According to Insafitri (2010), the extent to which a group of biota dominates another group can be known through the dominance index. Too much dominance will lead to an unstable and depressed group. The dominance index is analyzed using the Dominance of Simpson index with the formula:

$$D = \sum\left(\frac{Ni}{N}\right)^2$$

D = 2 where Pi = (ni/N).
Description: D = Dominance index of Simpson's dominance,
ni = number of individuals of each type,
N = total number of individuals.
The criteria for the dominance index according to Dominance of Simpson are as follows: 0 < D < 0.50 = Low dominance 0.50 < D < 0.75 = Medium dominance 0.75 < D < 1.00 = High dominance.

RESULTS

A. Location Characteristics

The Pahlawan University Botanical Garden has a topographic condition with a slightly hilly, sloping, steep valley area. The area for Block A (27 Ha) and Block B (125 ha). Block A of the Botanical Garden (Figure 2) has a Recipient Zone, Management Zone, and Collection Zone. This research activity focuses on the collection zone located in the Botanical Garden. The Botanical Garden Universitas Pahlawan has characteristics of areas consisting of secondary forests, rubber plantations, and oil palm plantations. The habitat area of the primates observed in this study tends to be a combination of secondary forests and plantation areas that have entered the Botanical Garden area. Several types of plants found in the Block A area of the Botanical Garden, namely *Artocarpus elasticus*, *Ficus variegata*, *Hevea brasiliensis*, and *Syzgium aqueum* are food sources for primates.

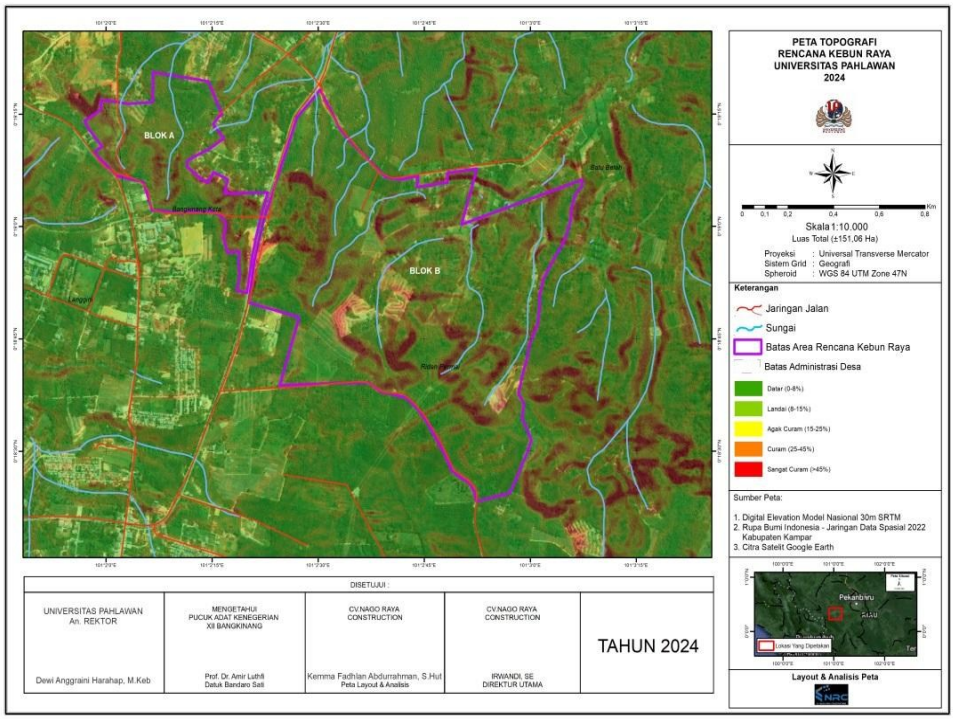

Figure 2. Map of the Botanical Gardens of Pahlawan University

B. Primate Composition at the Pahlawan University Botanical Garden

Based on the results of observations in zone A of the Botanical Garden, 3 primate species were found with 1 family Cercopithecidae and 2 genera, namely *Presbytis thomasii*, *Macaca fascularis*, and *Macaca nemestrina* with a total of 26 individuals spread across two different paths. The Valley Area path with dense tree vegetation found 14 individuals. The local fruit collection zone area is already slightly open. The results of primate observations are presented in (Table 1).

Table 1. Number of Primate species observed

Family	Genera	Species name	Number of Individuals		Total
			Valley	Local Fruits	
Cercopithecidae	*Presbytis*	*Presbytis thomasii*	8	6	13
	Macaca	*Macaca fascularis*	6	4	10
		Macaca nemestrina	0	2	2

C. Shannon wiener diversity index

Primate diversity in the Pahlawan University Botanical Garden is still relatively low, namely 0.14-0.52, and the dominance index is 0.08-0.54. The dominant primate is the Kedih (*Presbytis thomasii*) at 0.5 (Table 2).

Table 2. Primate Dominance and Diversity Index in the Botanical Garden University Pahlawan

Species name	Indeks Dominasi	Indeks Keragaman
Presbytis thomasii	0,54	0,52
Macaca fascularis	0,38	0,3
Macaca nemestrina	0,08	0,14

DISCUSSION

From the research results it was reported that the species with the largest number of individual populations found was the kedih group with 14 individuals, this is the kedih group, one of the primates that live in the valley zone area. The primate literature that was rarely found on the observation route was the macaque, namely 2 individuals. Macaques are omnivorous animals, however, macaques eat fruits. The Kedih primate tends to consume guava in the botanical garden area, so this factor causes the presence of these primates. Macaque food varies widely from fruits, seeds, mushrooms, leaves, and insects. Macaques prefer to eat ripe fruits. This animal always smells its food before eating it and in certain ways can separate food that is not suitable for consumption. Syatriandi (2022) stated that the distribution of an individual's population if food is available. The availability of abundant food will not create competition or competition for food between groups of the same species or different species (Ruskhanidar 2021). Primate diversity in line with the complex structure of the forest, tree diversity, availability of food sources, fertile soil, and climate similarities are important indicators of the richness of primate species (Supriatna, 2008). Data analysis shows that the valley and fruit areas have a low diversity index with an average value of 0.333. The low diversity of primates in the Botanical Garden area is thought to be due to the open habitat conditions in the Botanical Garden so that only certain primates inhabit it. In the Botanical

Garden area zone A, several types of *Syzygium* sp., *Alstonia scholaris*, *Artocarpus odoratissimus*, and Macaranga trees were found. Vegetation conditions strongly support primate diversity at an observation location (Ardian et al., 2018). Likewise, the dominance of primates in the botanical garden area was low with an average of 0.363. Description of primates found in the block A area of the Pahlawan University Botanical Gardens.

1. *Presbytis thomasii* (Kedih)

The classification of the Kedih monkey according to IUCN (2021) is as follows:

Kingdom : Animalia
Filum : Chordata
Kelas : Mamalia
Ordo : Primata
Famili : Cercopithecidae
Genus : *Presbytis*
Spesies : *Presbytis thomasi*

Figure 3. Kedih (*Presbytis thomasi*)

Kedih (*Presbytis thomasi*) is a primate endemic to Sumatra (Figure 3). Its natural habitat is found in dry tropical or subtropical forests (Figure 3). This primate has unique characteristics, namely having a tuft of hair and white undersides and arms (which stand out from other grayish or black fur) which is located around the upper neck (Syatriandi, 2022). Kedih's activities are mostly for eating, and resting rather than moving to find food (Ruskhanidar, 2021). Several reports have revealed that Kedih is found in the Aceh and North Sumatra regions (Ruskhanidar et al. 2020). Likewise, the research report of Utari et al. (2023) revealed that Kedih are found in the Alue Geima Tahura Pocut Meurah Intan Forest Management Resort (RPH) area, Aceh Besar Regency.

The observation results found that the kedih group often forages, plays, and rests in valley areas that have fruit-bearing plants, such as *Syzgium* spp., and *Hevea brasiliensis*. The kedih group tends to spend its time looking for fruit that is sour and bitter by avoiding high sugar or sweet. Kedih has the behavior of moving from tree to tree to forage, but sometimes kedih also goes down to the ground to look for food such as insects or moss.

2. *Macaca fascicularis* (Long-tailed macaque)

Kingdom : Animalia
Filum : Chordata
Kelas : Mamalia
Ordo : Primata
Famili : Cercopithecidae
Genus : *Macaca*
Spesies : *Macaca fascicularis*

Figure 4. *Macaca fascicularis* (Long-tailed macaque)

Characteristics of long-tailed monkeys are characterized by gray to brownish hair on the back, darker (Figure 4). The head has thick gray hair and sideburns around the face, a flat nose with a narrowed nose tip, and a long tail (Alanindra, 2015). These primates inhabit secondary forest habitats and areas close to settlements. These primates have a diverse diet, including fruits, meat, leaves, insects, and even foods commonly consumed by humans. Kamilah et al., (2022) revealed that long-tailed monkeys consume various types of food so they are classified as opportunistic omnivores. Long-tailed monkeys can be found throughout Southeast Asia, such as Sumatra, Java, and Kalimantan. In the observation, it was found that several individuals of long-tailed monkeys were resting. Azwir et al. (2021) stated that this behavior is a non-social activity that can consist of sitting, standing, lying down, and observing the surroundings, so that when the monkey is tired from intensive foraging, it will rest a lot. The morphology of long-tailed monkeys can be seen in Figure 3.

Macaca fascicularis groups are often seen doing activities around shady trees, especially fruit trees such as *Syzgium* spp., *Hevea brasiliensis* and *Ficus* sp. They show active social behavior, interacting with each other while foraging among the leaves and high branches of the trees. The presence of these long-tailed macaques adds to the ecological dynamics of the Botanical Gardens, becoming an interesting part for visitors who want to observe wildlife in a relatively natural environment. "This group is one of the groups that is always found in all observation transects. *Macaca fascicularis* groups often spend time in trees, but also come down to the ground to forage or move around.

3. *Macaca nemestrina* (Beruk)

The classification of macaques according to IUCN (2021) is as follows:

Kingdom : Animalia
Filum : Chordata
Kelas : Mamalia
Ordo : Primata
Famili : Cercopithecidae
Genus : *Macaca*
Spesies : *Macaca nemestrina*

Figure 5. *Macaca nemestrina* (Long-tailed macaque)

Pig-tailed macaques, this is because their tails stick out in the shape and size of a pig. Generally, macaques have dark backs and lighter lower bodies (Figure 5). Their body weight is between 5-15 kg. Macaques are generally terrestrial animals, but they are still good tree climbers. Macaque habitats are mostly found in rainforests but are also often found in fields and plantations. Generally, macaques like water, unlike primates. Macaque groups will separate into small groups during the day when looking for food. Macaques are omnivores with their main food being fruits, seeds, mushrooms, and invertebrates. Based on the International Union for Conservation of Nature (IUCN), macaques are classified as animals with Vulnerable conservation status. This animal is one of 12 Vulnerable mammals that have been identified in the RER.

In the Botanical Garden of the University of Pahlawan, the population of *Macaca nemestrina* can be found inhabiting relatively dense and quiet tree vegetation areas. This group tends to be found in areas with diverse topography, including hillsides and valleys, which provide a variety of food sources and shelter. Tall tree vegetation with dense canopies is a place for this group of macaques to rest, sleep, and seek protection from natural conditions. The preferred tree species are often fruit-bearing trees such as *Hevea brasiliensis*, and *Syzgium* spp.

Macaques in the Botanical Garden of the University of Pahlawan show diverse activities throughout the day. They are active during the day (diurnal), with most of their time spent foraging, interacting socially, and moving among the trees. Macaques tend to have foraging activities involving and collecting fruits, seeds, insects, and other plant parts. In addition, macaques also engage in social interactions in groups such as grooming (cleaning each other's fur), playing, and communicating through various vocalizations and facial expressions. The movement of this group is usually between trees with agility and coordination, using all four limbs to climb and jump. The vegetation of trees that are important places for macaques in the Botanical Gardens of the University of Pahlawan has certain characteristics. These trees generally have a complex structure with many branches, providing safe movement paths and places to rest. Fruit trees, such as *Ficus* sp. trees or other local forest trees, are the main attraction because they provide a source of food rich in nutrients. In addition, trees with dense canopies provide important shade, especially during hot weather.

CONCLUSIONS

Primate diversity in the Pahlawan University Botanical Garden is still low with an average diversity index of 0.333. There are a total of 26 individuals that can be grouped into three primate species, two genera and one family: *Presbytis thomasii* (14 individuals), *Macaca fascicularis* (10 individuals), and *Macaca nemestrina* (2 individuals). Types of trees as primate habitats in the Pahlawan University Botanical Garden are *Syzygium* sp., *Alstonia scholaris*, *Artocarpus odoratissimus*, and *Macaranga*. Research on primate diversity in the University Botanical Garden not only provides scientific insights but also forms the basis for effective conservation actions. By utilizing the results of this research, national and local programs can be designed in a more targeted, inclusive, and sustainable way, so that the preservation of primates and their ecosystems can be maintained for future generations.

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