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Conservation of *Murraya paniculata*: Creating an Ideal Environment at the Biodiversity Conservation Center

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Abstract

Murraya paniculata (Kemuning) is a highly valuable natural resource due to its ecological, aesthetic, and medicinal properties. However, its sustainability may be jeopardized by insufficient attention to plant conservation and environmental degradation. This study aims to evaluate the effects of various environmental factors on Murraya paniculata's growth and determine the optimal conditions for its cultivation. The research was conducted using an experimental approach, observing ecological parameters such as soil pH, soil temperature, air temperature, soil moisture, and light intensity and analyzing their relationship to plant growth. The results indicated that Murraya paniculata thrives best in an environment with a soil pH of 6.5, a soil temperature of 29°C, an air temperature of 31°C, soil moisture categorized as humid, and normal light intensity. These ideal conditions promote increased plant height, improved leaf health, and enhanced growth.

Keywords: Conservation, Environmental, Growth, Ideal environment, *Murraya paniculata*

1. Introduction

Murraya paniculata, commonly known as Kemuning, is native to tropical and subtropical regions, including Indonesia, where it flourishes in its natural habitat (POWO, 2023). This plant belongs to the Rutaceae family and is distinguished by its glossy green leaves, fragrant white flowers, and small oval-shaped fruits that appear throughout the year. *Murraya paniculata* can grow as a shrub or a tree, thriving optimally in tropical climates, particularly within wet tropical biomes (Gilman, 1999). In addition to its botanical features, this species possesses significant ecological, aesthetic, and medicinal value.

Murraya paniculata plays a significant role in the environment. Its fruits and flowers appeal to birds and bees (Gilman, 1999). The fragrant flowers attract natural pollinators, making this species an essential component of the local ecosystem. Furthermore, *Murraya paniculata* helps mitigate air pollution by absorbing harmful pollutants, thereby contributing to environmental sustainability (Mukhopadhyay et al., 2021)

The aesthetic value of *Murraya paniculata* lies in its attractive morphology, which features glossy green leaves, small fragrant white flowers, and small red fruits. Due to its dense foliage and ease of pruning, it is commonly used as a natural hedge, providing a neat and refreshing appearance. Additionally, this plant is often used as a garden decoration or as an ornamental plant in public spaces because of its ability to thrive in various environmental conditions (Dosoky et al., 2016).

Murraya paniculata has been widely used as a medicinal plant due to the presence of certain chemical compounds. These compounds include alkaloids, coumarins, flavonoids, steroids, and terpenoids (Yohanes et al., 2023). Traditional communities use this plant to treat asthma, diarrhoea, and hypertension (Safitri et al., 2020; Saqib et al., 2015). Furthermore, the species has been investigated for its cytotoxic (Ma et al., 2021), anti-inflammatory (Chen et al., 2020), antihyperlipidemic (Wei et al., 2020), antidiarrheal (Mandal et al., 2010), and antioxidant (Zhu et al., 2015). Given its diverse potential, *Murraya paniculata* should be recognized as a valuable plant resource.

However, the existence of *Murraya paniculata* is threatened by environmental degradation and a lack of attention to plant conservation. According to the Global Forest Watch report, Indonesia lost more than 9.75 million

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hectares of tropical primary forest between 2002 and 2020. This deforestation not only leads to the loss of natural habitats for plants but also contributes to a broader decline in environmental quality. Furthermore, low public awareness and limited conservation efforts for this species increase the risk of population decline.

Considering the various benefits of *Murraya paniculata*, conserving this plant is essential for ensuring the sustainability of biological resources. Conservation efforts play a crucial role not only in preserving the existence of *Murraya paniculata* but also in supporting broader environmental protection. Several previous studies have explored the biological activities, pharmacological properties, and ethnomedicinal uses of *Murraya paniculata* (Joshi & Gohil, 2023; Yohanes et al., 2023). Although these studies emphasize the medicinal potential of *Murraya paniculata*, research specifically addresses its conservation status and ecological importance remains limited. Therefore, this study highlights the need for *Murraya paniculata*'s conservation efforts within its natural ecosystem.

2. Material and Methods

This research aims to cultivate *Murraya paniculata* in an ideal environment as part of conservation efforts. The research was conducted at Bengkulu University from October 6 to November 28, 2024, at coordinates 3 o 45'27”S 102 o 16'30”E, using an experimental approach with a primary focus on the plant cultivation process and routine monitoring of plant growth. The observed environmental parameters included soil pH, moisture, air temperature, and light intensity. The procedures were carried out systematically, including site selection, preparation of planting media, the planting process, and monitoring plant growth and development to ensure optimal conditions for *Murraya paniculata* (Figure 1).

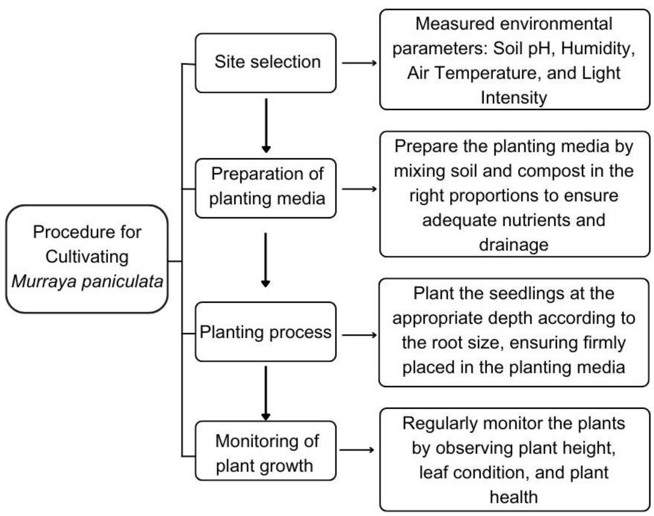

Figure 1. Research Diagram for Cultivating *Murraya paniculata*

Data collection on plant responses to maintenance activities was conducted by monitoring growth parameters, including plant height and overall health conditions. The planting procedures were designed to create optimal conditions that support natural plant growth. Data analysis was carried out descriptively to examine the relationship between environmental factors and plant growth parameters. The analysis results were used to evaluate the effectiveness of the treatments and the suitability of the ideal environment in supporting *Murraya paniculata* conservation efforts.

3. Results and Discussion

3.1. Physical Conditions of the Environment

Measurement of environmental data is crucial for determining the optimal conditions for the growth of *Murraya paniculata*. The environmental parameters assessed included soil pH, temperature, air temperature, soil moisture, and light intensity (see Figure 2). The results indicated that the soil pH was approximately 6.5, the soil temperature was 29°C, and the air temperature was 31°C. The environmental humidity was classified as humid, while the light intensity was categorized as normal (see Table 1).

Table 1. Results of measuring environmental, physical data

Parameter	Results
pH	6.5
Soil temperature	29 ^{o}
Water temperature	31 ^{o}
Soil moisture	Moist
Light Intensity	Normal

Environmental factors can significantly influence the growth of *Murraya paniculata*. Soil pH plays a crucial role in nutrient availability and mobility, essential for healthy plant growth (Neina, 2019). An imbalanced pH can hinder the absorption of key nutrients such as nitrogen, phosphorus, and potassium (Barrow & Hartemink, 2023).

Moreover, excessively acidic soil can inhibit plant roots from effectively absorbing nutrients, leading to nutrient deficiency and impaired growth (Msimbira & Smith, 2020).

Figure 2. Measurement of environmental and physical data using a soil tester

Air and soil temperature are key factors influencing various physiological processes in plants, including photosynthesis, respiration, and nutrient absorption. An optimal temperature range supports plant metabolism and overall physiological functions (Rosenblatt & Schmitz, 2016). However, extreme temperatures, either too high or too low, can negatively impact plant growth. Excessively high soil temperatures reduce the soil's capacity to retain water, increasing the risk of drought (FAO, 2004). Conversely, low soil temperatures can inhibit nutrient absorption, leading to nutrient deficiencies and restricted plant growth (Redhu et al., 2022).

Soil moisture is crucial for preventing drought and ensuring optimal water absorption by plant roots. Adequate water availability is essential for supporting photosynthesis and facilitating nutrient transport within the plant. Low humidity levels can lead to leaf drying and reduced photosynthetic efficiency. Additionally, decreasing soil moisture induces plant water stress at the point when it limits evapotranspiration (Fu et al., 2024). Conversely, excessive soil moisture can decrease oxygen availability to the roots, potentially causing root failure in nutrient absorption (Luo et al., 2024).

Light intensity plays a major role in the photosynthesis process. However, excessive light intensity can stress plants, leading to leaf drying and reducing the number of healthy leaves (Gómez-Bellot et al., 2023). Optimal light intensity ensures efficient energy absorption for growth, while deviations from this optimum can disrupt metabolic activities. Studies have shown that insufficient or excessive light affects photosynthetic efficiency andlters, plant morphology and overall vitality (Swoczyna et al., 2022; Wu et al., 2025).

Overall, the environmental conditions assessed in this study indicate that the selected environment was ideal for supporting the growth of *Murraya paniculata*. This species thrives in tropical areas with full sunlight and moderate water requirements (Nparks, n.d.). Additionally, a review by (Groppo et al., 2022) highlights that species in the Rutaceae family, including Murraya, generally perform well in tropical and subtropical regions with slightly acidic soils and moderate climates. Therefore, it can be concluded that the environmental conditions chosen in this study can provide a favorable habitat for the vigorous growth of *Murraya paniculata*.

3.2. Plant Growth

During the observation period, *Murraya paniculata* exhibited a height increase of 1–2.3 cm per week, with vibrant green leaves and the development of 1–3 new leaves weekly (Table 2; Figure 3). Overall, the plants remained healthy, showing no damage or disease, indicating a supportive growing environment.

Table 2 . Results of *Murraya paniculata* growth

Parameter	**Description (per week of observation)**
Plant Height	Average height increase 1–2.3 cm
Leaf Condition	Healthy green, addition of 3-5 new leaves
Plant Health	Plants are in healthy condition with no signs of disease or damage.

Figure 3. Growth conditions of *Murraya paniculata*

The *Murraya paniculata* plant exhibited good growth, with an average height increase of 1–2.3 cm per week during the study period. This suggests that stable soil and air temperatures created favorable conditions for its development. Additionally, the plant produced new leaves, indicating efficient photosynthesis and rapid vegetative growth (Y. Wang et al., 2023).

The growth of *Murraya paniculata* is significantly influenced by environmental factors, including soil pH, soil and air temperature, humidity, and light intensity. Based on the environmental measurements in the table, the soil pH was recorded at 6.5, which falls within the optimal range for *Murraya paniculata* growth. This plant thrives in soil pH levels between 5.5 and 7.0, as this range supports the availability of essential nutrients such as nitrogen, phosphorus, and potassium, which are crucial for metabolic processes and plant structure development. These nutrients are most available to plants within the optimal pH range, thus promoting healthy growth and development (Vasca-Zampir et al., 2019). This result is consistent with other research, which shows that most tropical plants, such as Plinia cauliflora , require a soil pH of 5.5 to 7.0 for optimal growth (Shabrina et al., 2024). Furthermore, this finding is supported by observing a consistent weekly increase in plant height.

Soil and air temperatures were recorded at 29°C and 31°C, respectively, within the optimal range for supporting the physiological activity of tropical plants such as *Murraya paniculata* . This temperature range increases the rate of photosynthesis without causing thermal stress. The optimal temperature for tropical plants ranges from 25°C to 32°C, ensuring the enzymes' efficiencyn carbohydrate synthesis (Mishra et al., 2023). Observations showed that the plant's leaves appeared a healthy green, with slight signs of yellowing, indicating that the temperature conditions supported the photosynthesis process.

Soil moisture, categorized as humid, influences water availability for transpiration and nutrient absorption by the roots. Adequate humidity helps maintain cell turgor pressure, ensuring the leaves remain fresh and do not wilt (Seleiman et al., 2021). High humidity reduces water loss through transpiration, which is essential for maintaining healthy leaf conditions (Trimble, 2021). Observations showed no signs of water deficiency in the plant's leaves, such as wrinkling or drying. These results indicate that the humid environment supports the physiological processes of *Murraya paniculata*.

The light intensity was within the normal range, allowing the photosynthesis process to occur optimally and providing the energy needed for new tissue formation and overall plant growth. Adequate light intensity significantly influences chlorophyll production and photosynthetic efficiency (W. Wang et al., 2025). *Murraya paniculata* exhibited a weekly increase in new leaves, indicating a positive response to optimal light availability.

Overall, the results of the environmental factor measurements indicate favorable conditions for the growth of **Murraya paniculata**. Combining ideal soil pH, optimal temperature, appropriate humidity, and sufficient light intensity creates a conducive environment for its development. Furthermore, the findings of this study are consistent with previous research, which demonstrates that **Murraya paniculata** thrives best under environmental conditions that ensure adequate nutrient availability and promote favorable growth (Fascella et al., 2021). This consistency is evident in observations of steady increases in plant height, healthy leaf conditions, and overall growth that align with expectations.

4. Conclusion

Murraya paniculata thrives best in an optimal environment characterized by a soil pH of 6.5, a soil temperature of 29°C, an air temperature of 31°C, adequate soil moisture in humid conditions, and normal light intensity. The interplay of these environmental factors fosters a supportive setting for plant growth. This is evidenced by consistent increases in plant height, healthy leaf conditions, and overall plant development, which align with established expectations.

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