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Exploration of Phytochemical and Morphological Profile *of Melastoma malabathricum* from Central Kalimantan as a Tropical Plant with Therapeutic Value

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Abstract

This study aimed to explore the morphological characteristics and phytochemical content of *Melastoma malabathricum*, a tropical plant native to Central Kalimantan, recognized for its therapeutic potential. Sampling was conducted purposively in its natural habitat, followed by morphological description and preliminary phytochemical tests to identify secondary metabolites using standard phytochemical screening methods (tube test). The results revealed that *M. malabathricum* exhibits distinctive morphological features in both vegetative and reproductive organs, including woody stems with prominent branches, single elliptical leaves with three pinnate veins and a hairy underside, bright purple flowers with prominent petals, small, round fruits that turn purple-black when ripe, and taproots with numerous branches. Phytochemical tests revealed the presence of flavonoids, tannins, saponins, and alkaloids, supporting the plant's pharmacological potential. Traditionally, this species has been used as a wound healer, anti-inflammatory agent, and antimicrobial remedy. *M. malabathricum* shows promise as a valuable source of natural bioactive compounds, facilitating research into the development of modern herbal medicines. These findings confirm that *M. malabathricum* not only exhibits unique morphological characteristics typical of tropical habitats but also holds significant potential for advancement in health and pharmacology. Due to its diverse secondary metabolite profile, this plant is an excellent candidate for phytopharmaceutical raw materials, warranting further research focused on isolating active compounds and evaluating their biological activities both in vitro and in vivo.

Keywords: Central Kalimantan, *Melastoma malabathricum*, Morphology, Phytochemistry, Therapeutic, Tropical Plant

1. Introduction

Indonesia, as a tropical country, boasts abundant biodiversity, including numerous medicinal plants with strategic value in health and agronomy (Hujjatusnaini et al., 2021; Iswahyudi et al., 2024). One tropical plant with significant potential, yet underutilized, is *Melastoma malabathricum* L., locally known as senduduk or karamunting (Ardiansyah et al., 2021; Hujjatusnaini et al., 2022). This species is widespread in Kalimantan, including Central Kalimantan, and grows naturally in diverse ecosystems, ranging from secondary forests to open lands, making it a valuable local bioresource with potential for development within a sustainable agronomic framework.

M. malabathricum has long been used in traditional medicine by local communities, primarily as a remedy for wounds and inflammation. Several previous studies have demonstrated that this plant contains important secondary metabolites, including flavonoids, tannins, saponins, terpenoids, steroids, and alkaloids (Widyastuti et al., 2021; Bunga et al., 2021; Puspitasari et al., 2022). These compounds not only exhibit biopharmacological activity but also show potential as therapeutic agents for metabolic diseases such as diabetes mellitus, particularly in the context of wound healing associated with diabetic ulcer complications.

Diabetes mellitus (DM) is a metabolic disorder characterized by high blood sugar levels (hyperglycemia) resulting from impaired insulin production or function, or a

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combination of both. DM remains a major health problem, with a steadily increasing prevalence (Sasmita et al., 2024). The prevalence of DM in Indonesia continues to rise, reaching 11.7% according to the 2023 Basic Health Research (Riskesdas). DM not only poses an economic and social burden but also increases the risk of serious complications such as diabetic ulcers. These complications are characterized by chronic foot wounds due to vascular disorders and peripheral neuropathy, as well as slow wound healing. Globally, the number of DM sufferers has reached 422 million people, with a prevalence of 8.5% in adults over 18 years of age. In 2016, 1.6 million deaths were directly caused by DM, while another 2.2 million deaths occurred due to complications. WHO predicts that DM will be the seventh leading cause of death in the world by 2030. Therefore, the development of local plant-based therapies with anti-inflammatory and regenerative properties is highly relevant.

Several previous studies have reported that *M. malabathricum* extract exhibits antihyperglycemic activity and accelerates wound healing in test animals (Spectrometry et al., 2023)—evidence of hypoglycemic effects by reducing blood sugar levels in alloxan-induced male white rats. A dose of 200 mg/200 g BW resulted in a decrease in blood sugar levels that was almost comparable to glibenclamide as a positive control. Habibi and Hariaji (2022) also reported the significant effectiveness of the plant extract in accelerating wound healing, with an average reduction of 8 days.

Research focused on the exploration of local plants, such as *M. malabathricum,* is crucial for supporting local germplasm conservation and the development of tropical plant commodities with economic and therapeutic value. Morphological studies and phytochemical analyses from various growing regions enable the identification of superior species with potential for cultivation or further development through an integrated agronomic approach.

This study fundamentally differs from previous research by utilizing distinct extract fractions, employing more specific testing methods, incorporating biochemical parameters such as antioxidant enzyme activity and tissue histopathology, and applying a broader range of doses across various test subjects. Consequently, this study not only confirms the antihyperglycemic effect but also offers a more comprehensive understanding of the mechanism of action and the potential for developing *Melastoma malabathricum* as a viable herbal therapy candidate.

This study aims to investigate the morphological characteristics and phytochemical content of *M. malabathricum* growing in Central Kalimantan. By mapping the morphological traits and bioactive compounds of these plants, this research aims to provide a scientific foundation for developing potential tropical plants as sources of raw materials for natural medicines. Additionally, it aims to support the advancement of adaptive and sustainable agronomic systems in tropical regions. By enriching and validating existing information, the findings may contribute to the development of health products for treating diabetic ulcers.

2. Material and Methods

This research employed an exploratory survey approach, incorporating direct observation of plant morphology. Sampling employed a purposive sampling method to identify areas considered relevant and representative based on specific criteria. The sampling location is in the Sungai Paring area, Cempaga District, East Kotawaringin Regency, Central Kalimantan, at coordinates (-2.3456° S, 113.9534° E), with an altitude of approximately (± 25 meters) above sea level.

Figure 1. Research Location Map

Research on the analysis of morphology and secondary metabolite compounds in plants was conducted at the Microbiology Laboratory of the Biology Education Study Program, IAIN Palangkaraya, from June to August 11,

2025. This approach enabled researchers to obtain more accurate data regarding the physical and morphological characteristics of *M. malabathricum plants* (Hujjatusnaini et al., 2024). The tools used included an Olympus CX23 monocular light microscope for observing morphological structures, an Ohaus Pioneer PX224 analytical balance for weighing samples, a Heidolph Laborota 4000 rotary evaporator for the extraction process, and a Shimadzu UV-1800 UV-Vis spectrophotometer for phytochemical analysis, equipped with standard laboratory glassware (Pyrex®). All tools were used in accordance with standard operating procedures to ensure the accuracy of the results. The research stages follow the following flowchart.

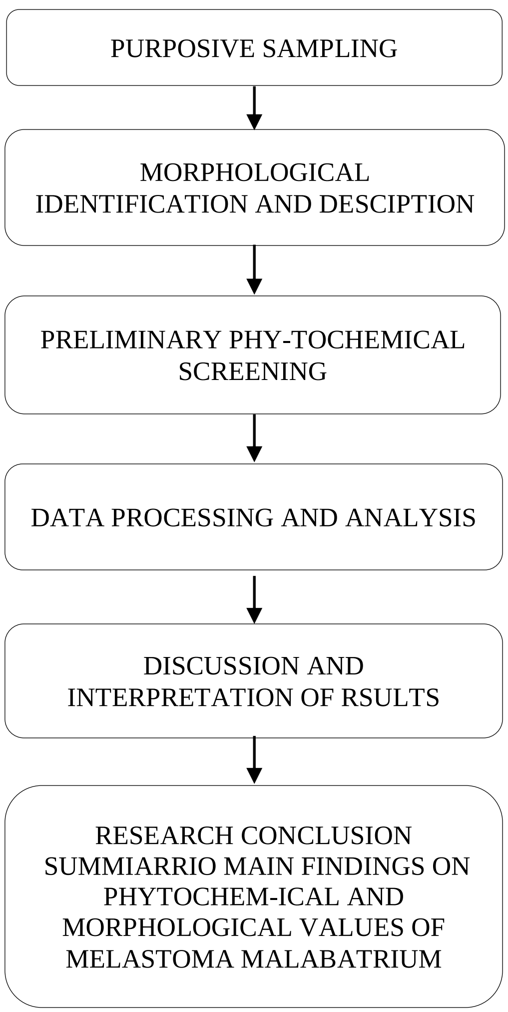

Figure 2. Research stages

This research began with a literature review aimed at an in-depth examination of various scientific literature related to *M. malabathricum*, particularly regarding its phytochemical, morphological, and therapeutic potential. This study included a search for references from scientific journals, textbooks, and previous research results to gain a comprehensive understanding of the agronomic value and pharmacological benefits of the plant, as well as to identify research gaps that can serve as a basis for developing research focuses.

The next stage involves identifying and formulating the problem, which is carried out based on the results of the literature study and initial field observations. The primary concern addressed in this study is the need to investigate the morphological characteristics and phytochemical compound content of *M. malabathricum* growing in Central Kalimantan, as it is suspected that local geographic and environmental conditions may influence the expression of secondary metabolites in the plant. Thus, the researchers formulated a research direction to address this problem scientifically.

After formulating the problem, the researcher set research objectives which included three main things, namely: (1) describing the morphological characteristics of *M. malabathricum* from Central Kalimantan, (2) identifying the content of phytochemical compounds such as flavonoids, tannins, alkaloids, and saponins, and (3) evaluating the potential of the plant as a source of natural ingredients for the development of alternative therapies, especially in cases of wounds due to diabetes complications.

M. malabathricum leaf samples were collected directly from its natural habitat in Central Kalimantan. This process involved field taxonomic identification of the plant, representative leaf sampling from several locations, and recording the environmental conditions under which the plant grew. The collected leaves were then dried and stored according to standard procedures to prevent degradation of the active compounds before further analysis.

For plant morphological analysis, identification was carried out by referring to the Flora of Java (Backer & van den Brink, 1963) and the modern identification book Plant Resources of South-East Asia (PROSEA) - Medicinal and Poisonous Plants (de-Padua, Bunyapraphatsara & Lemmens, 1999), which was used as the main guide in recognizing the morphological characters *of M. malabathricum.*

The final stage of this research included phytochemical and morphological analyses. Morphological analysis was conducted by observing the physical characteristics of the plants, including leaf shape and size, color, surface texture, and stem and flower characteristics, where available (Zaman, 2024). For phytochemical analysis, qualitative testing was performed using test tube methods, including alkaloids (Mayer/Dragendorff), flavonoids (Shinoda), tannins (gelatin), saponins (foam test), and terpenoids–steroids (Liebermann–Burchard) (Harborne, 1998; Zaman, 2024). The sample extraction procedure began with the preparation of fresh material, which was cleaned, dried in a low-temperature oven, and ground into powder. The powder was extracted with 70% ethanol by maceration for 24–48 hours at room temperature, with 30 minutes of ultrasonic assistance to increase extraction efficiency (Ultrasonic-Assisted Extraction, UAE), which has been shown to enhance the yield of bioactive compounds (Jovanović et al., 2018). The filtrate was then filtered (Whatman No. 1 paper), re-extracted until clear, and all filtrates were combined. The resulting extracts were evaporated using a rotary evaporator at 40–45 °C, then dried in a vacuum desiccator, and weighed to calculate the yield (% w/w). The extracts were then stored at 4°C until further phytochemical analysis was conducted.

Determination of total flavonoid content in *Melastoma malabathricum extract* was carried out using a colorimetric method based on the reaction with aluminum chloride ($AlCl_3$). This method relies on the ability of flavonoid compounds to form stable yellow complexes with Al^{3+} ions, which can be detected quantitatively using a spectrophotometer at a wavelength of 415 nm (Chang et al., 2002; Marinova et al, 2005). As a reference standard, quercetin was used, dissolved in 96% ethanol to form a stock solution with a concentration of 1000 µg/mL. This solution was then diluted in stages to obtain a series of standards with concentrations of 20, 40, 60, 80, and 100 µg/mL, which were used to prepare a calibration curve (Kumaran & Karunakaran, 2007).

Dried and ground *Melastoma malabathricum* leaf extract was dissolved in a 96% ethanol solvent to achieve a specific concentration, for example, 1 mg/mL. After homogenization, the sample solution was filtered or centrifuged to remove suspended particles. The analysis procedure began by adding 1 mL of standard solution or sample to a test tube, followed by the addition of 0.3 mL of 10% aluminum chloride solution, 0.3 mL of 1 M sodium acetate, and 2.4 mL of 96% ethanol. The mixture was shaken using a vortex until homogeneous, then incubated for 30 minutes at room temperature under conditions protected from direct light (Chang et al., 2002; Pourmorad et al, 2006; Sembiring et al., 2018).

After the incubation process was completed, the absorbance of the solution was measured using a UV-Vis spectrophotometer at a wavelength of 415 nm, with ethanol as a blank. The standard absorbance value was used to create a calibration curve between the quercetin concentration (µg/mL) and absorbance, yielding a linear regression equation. The total flavonoid concentration in the sample was calculated by entering the sample absorbance value into the equation, and the results are expressed in units of milligrams of quercetin equivalents per gram of dry extract (mg QE/g).

All tests were carried out in three repetitions (triplicate) to ensure the accuracy and precision of the results. This procedure enables researchers to obtain a quantitative understanding of the flavonoid compounds contained in Melastoma malabatricum extract, which is closely related to its biological activity and therapeutic potential.

3. Results and Discussion

This section presents the results of the morphological characterization of *Melastoma malabathricum* plants observed directly in the field. The observations focused on the plant's main organs, including roots, stems, leaves, flowers, and fruits. Each part was examined based on established morphological indicators, including color, shape, size, texture, and structure. Visual data, in the form of photographic documentation, was used to support the observations and provide a more comprehensive understanding of the findings. Figure 3 illustrates the primary components of the *Melastoma malabathricum* plant.

3.1. *Melastoma malabathricum* plant

The *Melastoma malabathricum* plant, also known as Karamunting or senduduk, is a member of the Melastomataceae family (Purnama et al., 2020). This plant is widely distributed in the forests of the Indonesian archipelago (Anggreani, 2024).

M. malabathricum has distinctive morphological characteristics. This plant features purple flower crowns, making it a popular choice as an ornamental plant. Its fruit is also often eaten, especially by people living in rural areas (Purnama et al., 2020). Besides its aesthetic and culinary value, this plant is also known to possess various pharmacological properties.

Several studies have demonstrated that *M. malabathricum* contains polyphenols, flavonoids, tannins, and saponins, which exhibit specific physiological activities, including analgesic, antimicrobial, antipyretic, anti-inflammatory, and antibacterial properties. (Yuska Noviyanty, 2020) . Therefore, this plant is often used in traditional medicine to aid in the treatment of antinociceptive, anti-inflammatory, wound-healing, antidiarrheal, cytotoxic, and antioxidant properties. Based on field observations, the following table presents the morphological characterization of the plant. *M. malabathricum* as a basis for further analysis and discussion.

3.1.1. Root Morphology

The morphological characteristics of *M. malabathricum roots* are pale brown to dark brown on the outside, while the inside is pale cream. The root shape is a taproot that extends downwards, with a root type in the form of a taproot system that plays an important role in supporting the plant upright and absorbing water from deeper soil layers. The composition of the root tissue consists of epidermis, cortex, cuticle, endodermis, xylem, pith, phloem, and a central cylinder, with the presence of fine root hairs that expand the absorption surface.

Figure 3. Primary components of the *Melastoma malabathricum* plant. (a) *Melastoma malabathricum*; (b) Root; (c) Steam; (d) Leaf; (e) Fruit; (f) Flower.

The root texture is generally smooth to slightly fibrous, depending on the age of the plant and the growing medium conditions. The length of the main root can reach 30–50 cm, while lateral roots range from 10–20 cm. The diameter of the main root is usually 0.5–1.5 cm in young plants in natural habitats, and can be larger in loose soil. (Irwanto et al., 2023) . A deep, penetrating taproot enables the plant to access water reserves during the dry season, while numerous, spreading lateral roots facilitate the uptake of nutrients that are limited in the topsoil. Dense root hairs in the absorption zone enhance the efficiency of micronutrient uptake, such as iron (Fe) and manganese (Mn), which are typically limited in acidic soils. (Irwanto et al., 2023).

3.1.2. Stem Morphology

The stem of *M. malabathricum* has a cylindrical shape and grows upright. The stem color varies with the age of the plant, ranging from a brownish-green hue in its young phase to a dark brown color when mature. The surface is covered with fine hairs (trichomes) that give a somewhat rough impression. The stem diameter of young wild plants is generally 0.5–1.5 cm, but can reach 3 cm if grown in fertile soil. The main stem can reach lengths of more than 2 meters in its natural habitat. Stem segments (internodes) measure 2–5 cm, while stem nodes serve as the points where leaves and branches emerge. Branching is sympodial, spreading evenly to form a dense, bushy canopy that suits the habit of annual or biennial plants with taproots (Bakewell-Stone, 2022).

The stem structure consists of an outer epidermal layer containing trichomes, followed by cortex tissue, vascular cambium, and a central cylinder containing xylem and phloem, which play a role in nutrient and water transport. Secondary thickening of the woody tissue provides mechanical strength to support dense branches and leaves, thereby enhancing their resilience. The spreading branching maximizes light capture, while the trichomes function to reduce transpiration and protect against attacks by small herbivores (Kiew & Wong, 2023).

The stem can change color from green to brown due to lignification and the development of woody tissue. This change marks a shift in the stem's function from photosynthesis to structural and transport roles. This robust stem characteristic makes *M. malabathricum* effective as a windbreak, reforestation of marginal land, and erosion prevention in sloping or open areas (Lucidcentral, 2024).

3.1.3. Leaf Morphology

The M. malabathricum plant has a rough leaf surface. Dark green and hairy, the underside is light green, thick, stiff, and covered in rough trichomes that function to reduce the rate of transpiration and protect the leaf tissue from herbivore attacks. The leaf shape varies from elliptical to oval, lanceolate, and pointed, with a length of 6–15 cm and a width of 2–8 cm. The tip is acuminate, the base is blunt or slightly pointed, and the margin is even (entire). Another prominent characteristic is the leaf vein pattern, consisting of one main vein accompanied by four parallel veins extending from the base to the tip, which is a distinctive feature of the *Melastomataceae family*. (Wati Haron et al., 2015) .

Table 1. Morphological Characterization of *M. malabathricum*

Organ	Organ Character	Morphological Characteristics
Root	Root Color	Pale brown to yellowish brown
	Root Form	Elongated cylindrical, tapering at the tip, finely branched.
	Root Type	Taproot system
	Root Structure	Epidermis, cortex, central cylinder, phloem
	Root Texture	Smooth to slightly rough
	Main Root Length	20-50 cm
	Lateral Root Length	5-15 cm
	Root Diameter	±0.5-1.5 cm on leafy plants
Stem	Bar Color	Brownish green to dark brown
	Stem Shape	Astigmatism
	Stem Diameter	± 0.5-3 cm
	Stem Length	0.5-3 cm
	Stem Surface	Smooth, slightly hairy
	Internodes	Length, ± 1-4cm
	Node Book	It is clearly visible where the leaves and branches grow.
	Branching	Growing from leaf axils, branching a lot
	Stem Strength	Strong enough to support crowns and flowers
Leaf	Leaf Color	Dark green on the upper surface (adaxial) pale light green on the lower surface (abaxial)
	Leaf Shape	Elliptical to lanceolate
	Leaf Tip	Long pointed or tapered.
	Leaf stalk (Petiole)	Length ±0.5–1.5 cm, short hair
	Leaf Edge	Flat (entire), not jagged
	Leaf Bones	Pinnate, clearly visible
	Leaf Width	Approximately ±1.5–7 cm per leaflet
	Leaf Length	±5–20 cm per leaflet
	Leaf Surface	Rough, hairy
	Leaf Type	Single leaf, not split.
	Leaf Base	Tapered to blunt
	Leaf Arrangement	Opposite
	Leaf Texture	Thick, flexible, and somewhat stiff
Flowers & Seeds	Flower	Single or clustered flowers, light purple to reddish purple
	Seed	Small, elliptical, light brown to dark brown

M. malabathricum leaves are simple, oppositely arranged on the stem. The petiole is relatively short (0.5–1.5 cm) and finely haired. The leaf blade is thick and coriaceous due to a well-developed mesophyll layer, which promotes water retention during the dry season. The upper surface of the leaf is smoother, while the underside tends to be hairier—a characteristic that helps pioneer plants like *M. malabathricum* survive in open areas. Differences in color and texture are also evident in young leaves, which are paler and softer than older leaves, which are darker and tougher. (Beltsazar et al., 2024) .

These leaf morphological traits are closely related to *M. malabathricum*'s ability to adapt to acidic and nutrient-poor soils. Trichomes on the underside of the leaves not only suppress water loss but also reflect excess light, reducing damage from UV radiation. The robust leaf veins provide mechanical support for the large leaf blades, enabling them to capture light efficiently in open habitats. This combination of characteristics makes *M. malabathricum* important in stabilizing degraded land and restoring ecosystems in tropical regions.

3.1.4. Flower and Seed Morphology

M. malabathricum flowers are usually arranged in terminal or axillary panicles of 2–7 flowers, with leaf-shaped bracts at the base as protection. The lower part of the flower is slender and rounded, measuring 5–9 mm in length, and its surface is covered with small, dense scales. The corolla consists of 5 obovate petals, 25–35 mm long, and 40 mm in optimal conditions. (Zheng et al., 2019) .

The flower stamens are dimorphic—five yellow filaments with hooked purple anthers and connectives, and five others are shorter with reddish purple anthers (Joffry et al., 2011).

The fruit is a fleshy capsule in the shape of an urnea-globular, with a length of 6–15 mm and a width of 6–12 mm, featuring a scaly surface. When ripe, it opens irregularly to reveal dark blue flesh with dark orange seeds. (Bakewell-stone, 2022)

Fertile seeds are folded or spiral, measuring 0.45–0.8 mm long, 0.35–0.6 mm wide, and 0.17–0.3 mm thick, and are light yellow or pale cream in color at the testa. In addition, there are non-fertile seeds, which are smaller (0.3–0.5 mm × 0.2–0.3 mm × 0.2 mm), often collapsed, wrinkled, and black to red-black in color (Zheng et al., 2019).

Phytochemical tests were conducted on three *M. malabathricum leaf samples* collected from different locations, with each sample analyzed in three replicates to ensure consistency of the results. The characterization results are presented in Table 2.

Table 2. Characterization of the Phytochemical Profile *of Melastoma malabathricum*

Parameters	Phytochemical Characterization	*Melastoma malabathricum*
Flavonoid	Orange brown	(+)
Alkaloid	Dark brown	(+)
Terpenoid	Reddish brown	(+)
Tannin	Blackish green	(+)
Phenol	blackish green	(+)
Saponin	Foamy	(+)

Phytochemical test results showed that *M. malabathricum extract* contains several secondary metabolite compounds, characterized by color changes or precipitation formation, depending on the reagent used. Flavonoid tests showed positive results, with a color change to orange-brown, indicating the presence of flavonoid compounds in the extract. Flavonoids found in *M. malabathricum* have bioactive compounds with high antioxidant activity and play a role as anti-inflammatory agents and supporters of the tissue regeneration process (Bakewell-stone, 2022).

Alkaloids also yield positive results, characterized by a dark brown color, which indicates the presence of alkaloids. The alkaloid content possesses analgesic, antimicrobial, and anti-inflammatory properties, thereby supporting the traditional medicinal function of this plant.

Terpenoid compounds were also found, indicated by a reddish-brown color in phytochemical tests. These compounds contribute to antimicrobial activity and can accelerate wound healing by stimulating tissue regeneration.

Furthermore, a positive result was also indicated by the formation of a blackish-green color in the tannin test. Tannins have astringent properties, inhibiting microbial growth and helping stop minor bleeding. Phenolic compounds were also detected, exhibiting similar characteristics, including a blackish-green color, which indicates the presence of phenolic compounds with antioxidant and antimicrobial properties. The saponin test yielded a positive result, indicated by the formation of a stable foam. The presence of saponins suggests that the extract possesses immunostimulant and antibacterial properties, which can accelerate the wound healing process (Rusli et al., 2021).

Overall, the results of this phytochemical test indicate that *M. malabathricum* is rich in secondary metabolites, including flavonoids, alkaloids, terpenoids, tannins, phenols, and saponins. This combination of compounds strengthens the scientific basis for the use of this plant in traditional medicine, particularly as an antioxidant, antimicrobial, anti-inflammatory, and wound-healing agent.

The determination of total flavonoid content was carried out using a colorimetric method with aluminum chloride ($AlCl_3$) as the reagent, and quercetin was used as the standard. Absorbance was measured at a wavelength of 415 nm using a UV-Vis spectrophotometer, as presented in Tables 3 and 4.

Table 3. Quercetin Standard Curve Data

Quercetin Concentration (μg/mL)	Absorbance (415 nm)
20	0.182
40	0.366
60	0.552
80	0.74
100	0.92

Linear regression equation: $y = 0.0092x – 0.002$ ($R^2 = 0.999$).

The quercetin standard curve data showed a strong linear relationship between quercetin concentration and absorbance values measured at a wavelength of 415 nm. Each increase in quercetin concentration consistently. Produces an increase in absorbance, which indicates that the quercetin compound forms a stable colored complex with aluminum chloride ($AlCl_3$), so it can be detected spectrophotometrically. Based on the results of the regression analysis, a linear equation of $y = 0.0092x-0.002$ was obtained with a coefficient of determination (R^2) of 0.999. This equation illustrates that approximately 99.9% of the variation in absorbance values can be attributed to variations in quercetin concentration, indicating that this regression model exhibits a very high level of accuracy and consistency.

The regression coefficient of 0.0092 indicates that a 1 µg/mL increase in quercetin concentration results in a corresponding increase in absorbance value of 0.0092. Meanwhile, the intercept value of -0.002 is very small and close to zero, which strengthens the validity of the linear relationship between the variables. Thus, this regression equation can serve as a basis for quantitatively calculating the total flavonoid content in plant extracts. For example, if a sample exhibits an absorbance value of 0.615, the flavonoid equivalent concentration of quercetin in that sample can be calculated by entering that value into the regression equation, which yields a concentration of approximately 67.06 µg/mL.

Table 4. Sample Absorbance Data

Test	Absorbance (415 nm)
20	0.614
40	0.622
60	0.608
Average absorbance = 0.615	
Flavonoid content in the extract sample = 67.06 µg/mL	
Total flavonoid content = 67.06 mg EQ/g dry extract	

Based on the absorbance data obtained from three replicate tests of *Melastoma malabathricum leaf extract* at a wavelength of 415 nm, the absorbance values recorded were 0.614, 0.622, and 0.608, respectively. These three values were relatively consistent, indicating that the measurement method had good reliability. From these three replicates, an average absorbance of 0.615 was obtained, which was then used as the basis for calculating total flavonoid levels using a linear regression equation obtained from the quercetin standard curve, namely $y = 0.0092x - 0.002$.

The average absorbance value in the regression equation shows that the flavonoid content in the extract sample is 67.06 µg/mL. Considering that the test was carried out with an extract concentration equivalent to 1 mg/mL, this value is equivalent to 67.06 mg of quercetin equivalents per gram of dry extract (mg QE/g). This value indicates that *Melastoma malabathricum leaves* from Central Kalimantan contain a fairly high total flavonoid content, suggesting the potential of bioactive compounds in them, particularly those with antioxidant, anti-inflammatory, and antidiabetic properties.

These findings support the hypothesis that the plant has the potential to be developed as a natural ingredient in alternative medicine or therapy, particularly for conditions related to oxidative stress or metabolic disorders such as diabetes mellitus and its associated chronic wound complications. The high flavonoid content could provide a scientific basis for further exploration in the formulation of herbal products or phytopharmaceuticals derived from local tropical plants.

In the context of agronomy and biodiversity, information on the content of bioactive compounds, such as flavonoids, is crucial for breeding, conservation, and utilization of tropical plants, whether as medicinal plants, horticultural commodities, or raw materials for the phytopharmaceutical industry. This study also emphasizes the importance of exploring endemic or semi-wild plants with high adaptive potential and not yet widely cultivated agronomically.

This research not only contributes to knowledge regarding the biochemical composition of *Melastoma malabathricum* but also highlights the importance of developing local tropical plants as biological resources with economic and therapeutic value.

Morphological and phytochemical exploration of *Melastoma malabathricum* from the Paring River region in Central Kalimantan reveals that this species exhibits distinctive morphological characteristics and contains secondary metabolites with therapeutic potential. Its robust root structure and woody stem indicate the plant's adaptation to open, tropical environments with high humidity. Its undersides are downy, and its flowers are distinctive features that support its taxonomic identification (Hujjatusnaini et al., 2022).

Phytochemically, the presence of flavonoids, tannins, alkaloids, saponins, steroids, and terpenoids indicates that *Melastoma malabathricum* is a bioactive plant rich in secondary metabolites. Test results showed positive reactivity for all tested compounds, corroborating previous studies by Widyastuti et al. (2021) and Puspitasari et al. (2022), which reported the presence of these compounds in this species from different locations.

The high total flavonoid content (67.06 mg EQ/g dry extract) is highly significant, considering that flavonoids play a crucial role as antioxidants, anti-inflammatories, and antidiabetics. This content helps mitigate oxidative stress and inflammation associated with diabetic complications, including diabetic ulcers. This pharmacological effect has also been confirmed in studies by Spectrometry et al. (2023) and Habibi & Hariaji (2022), who reported that *Melastoma malabathricum* extract effectively reduced blood glucose levels and accelerated wound epithelialization in test animals.

The correlation between the growing environment (tropical Kalimantan with high humidity and semi-peat soil) and variations in secondary metabolite expression also indicates that geographic conditions influence plant phytochemical quality. This finding aligns with the statement by Hujjatusnaini et al. (2022) that the environment and local adaptation have a direct impact on plant chemical diversity.

Melastoma malabathricum from Central Kalimantan not only shows potential as a source of herbal medicine raw materials but also supports the development of a sustainable, biodiversity-based local agronomic system. This discovery underscores the importance of conserving local germplasm and cultivating high-value tropical plants as part of a future biopharmaceutical strategy.

4. Conclusion

Based on the observations, the *M. malabathricum* karamunting plant exhibits distinctive morphological characteristics in both its vegetative and generative organs. Its stem is woody with clearly defined branching; its simple leaves are elliptical with three-pinnate veins and a downy underside. The flowers are bright purple with prominent petals, and the fruit is small, round, and blackish-purple when ripe. The roots are taproots with extensive branching. This plant is known to contain various secondary metabolites, including flavonoids, tannins, saponins, and alkaloids, which support its traditional medicinal uses, such as wound healing, anti-inflammatory, and antimicrobial applications. Thus, *M. malabathricum* is significant not only from a morphological perspective as a typical species of tropical habitats but also holds great potential for development in health and pharmacology.

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References

Agustin, Y., Sapada, E., Wilsya, M., Studi, P., Farmasi, S., Siti, S., & Palembang, K. (n.d.). *Melastoma malabathricum* L. pada tikus putih jantan. *Jurnal Kedokteran dan Ilmu Kesehatan, 11*(1), 55–60. https://doi.org/10.52395/jkjims.v11i01.323

Anggreani, L. (2024). Morfologi sel darah pada sediaan apusan darah tepi (SADT) tipis menggunakan pewarna alternatif ekstrak bunga senduduk (*Melastoma malabathricum* L.). *Sekolah Tinggi Ilmu Kesehatan Borneo Cendekia Medika Pangkalan Bun.*

Bakewell-Stone, P. (2022). *Melastoma malabathricum* (Banks melastoma). *PlantwisePlus Knowledge Bank, Species Pages.* https://doi.org/10.1079/pwkb.species.33489

Beltsazar, E. D., Marshellina, C. J., Safitdra, A., Asseggaf, S. N. Y., Rizki, S., & Zakiah, M. (2024). Potensi daun kemunting (*Melastoma malabathricum*) sebagai obat tradisional suku Dayak Desa dalam penyembuhan luka. *Jurnal Kedokteran dan Kesehatan: Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya, 11*(1), 1–8. https://doi.org/10.32539/jkk.v11i1.226

Chang, C.-C., Yang, M.-H., Wen, H.-M., & Chern, J.-C. (2002). Estimation of total flavonoid content in propolis by two complementary colorimetric methods. *Journal of Food and Drug Analysis, 10*(3), 178–182. https://doi.org/10.38212/2224-6614.2748

Habibi, A., & Hariaji, I. (2022). Uji perbandingan efektivitas daun senduduk (*Melastoma malabathricum* L.) dengan betadin terhadap waktu penyembuhan luka sayat pada tikus putih jantan galur Wistar. *Jurnal Ilmiah Simantek, 6*(3), 8–15.

Hujjatusnaini, N., Amin, A. M., Febrianty, R., Maisyarah, A., Agriana, B. M., Septianingrum, D. D., Maradona, W., Sari, N. W., & Siti, M. (2022). Perbandingan kemampuan adaptasi bakteri *Staphylococcus aureus* dan *Escherichia coli* pada ekstrak daun karamunting (*Melastoma malabathricum*). *BioScientia: Jurnal Biologi dan Pendidikan Biologi, 11*(1), 96–104. https://doi.org/10.33477/bs.v11i1.2534

Irwanto, K., Kuntorini, E. M., & Fariani, R. (2023). Struktur anatomis dan uji histokimia tanin pada organ vegetatif dan reproduktif *Rhodomyrtus tomentosa* (Ait.) Hassk. *Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia, 9*, 126–132. https://doi.org/10.13057/psnmbi/m090119

Kumaran, A., & Karunakaran, R. J. (2007). *In vitro* antioxidant activities of methanol extracts of five *Phyllanthus* species from India. *LWT - Food Science and Technology, 40*(2), 344–352. https://doi.org/10.1016/j.lwt.2005.09.011

Rizki. (2021). Studi morfologi organ vegetatif karamunting *Rhodomyrtus tomentosa* (Ait.) Hassk. *Jurnal Agriculture Science, 1*, 21–26.

Rusli, L. S., Osman, N., Abdullah, R., Yaacob, J. S., & Seow, A. H. (2021). Effects of palm kernel biochar on the physiological responses and root profiles of sendudok (*Melastoma malabathricum* L.) grown on acidic soil. *Applied Ecology and Environmental Research, 19*(4), 2887–2903. https://doi.org/10.15666/aeer/1904_28872903

Sembiring, E. N., Elya, B., & Sauriasari, R. (2018). Phytochemical screening, total flavonoid and total phenolic content and antioxidant activity of different parts of *Clerodendrum inerme* (L.) Gaertn. *Journal of Young Pharmacists, 10*(4), S373–S378. https://doi.org/10.5530/jyp.2018.10.82

Spectrometry, C., Wirawan, I. G. P., Ayu, I., & Darmawati, P. (2023). Kandungan fitokimia dan aktivitas antioksidan dari daun tumbuhan senduduk (*Melastoma malabathricum* L.) dengan metode GC-MS. *Asian Journal of Applied Sciences, 13*(3), 403–414. https://doi.org/10.24843/AJoAS.2023.v13.i03.p10

Wati Haron, N., Anuar, N., & Veeramohan, R. (2015). The taxonomic significance of leaf micromorphology in the genus *Melastoma* L. (Melastomataceae). *Sains Malaysiana, 44*(5), 643–650. https://doi.org/10.17576/jsm-2015-4405-01

Yuska, N., & Noviyanty, A. M. L. (2020). Profile of phytochemistry compounds metabolite. *Journal of Pharmaceutical Science, 3*(1), 1–6. https://doi.org/10.36490/journal-jps.com.v3i1.34

Zaman, W. (2024). Morphology, palynology, and phytochemicals of medicinal plants. *Horticulturae, 10*(3), 202. https://doi.org/10.3390/horticulturae10030202

Zheng, T., Lin, Y., Wang, L., Lin, Q., Lin, X., Chen, Z., & Lin, Z. (2019). *De novo* assembly and characterization of the floral transcriptomes of two varieties of *Melastoma malabathricum*. *Frontiers in Genetics, 10*, 521. https://doi.org/10.3389/fgene.2019.00521