Morphological Characteristics of Cinnamon (*Cinnamomum burmanni* (Nees & T. Nees) Blume) Population in Agam Regency, West Sumatra

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Abstract. The cinnamon tree (*Cinnamomum burmanni*) is a valuable spice resource with significant economic importance and Sumatra is one of the major cinnamon-producing centers in Indonesia. This study aimed to examine the morphological characteristics of the cinnamon tree population in the Agam Regency, West Sumatra using a purposive sampling method. Data was collected through field surveys and direct observations of the cinnamon tree population using a cinnamon descriptor. Morphological aspects such as qualitative and quantitative traits were analyzed. The study found significant differences in these features among cinnamon trees, which varied in height from 10 to 17 meters and stem diameters from 19.43 to 25.48 cm. The bark has a thickness of 0.24 to 0.66 cm. Leaves also showed variations in shape, size, and color across individuals. Branch structures exhibited no differences in branching levels and leaf distribution. The cinnamon tree population in Agam Regency exhibits morphological diversity and promising cinnamon production, which is essential for conservation and breeding efforts to enhance productivity and sustain local ecosystems.

1 Introduction

Cinnamomum burmanni (Nees & T. Nees) Blume), also referred to as Indonesian cinnamon, is a plant belonging to the Lauraceae family. In Indonesia, cinnamon trees spread from the islands of Sumatra, Java, Kalimantan to the east of Indonesia like the West Nusa Tenggara [1-2]. The bark of Indonesian cinnamon is highly prized for its culinary use as a spice, as well as for its essential oils. This species is renowned for its powerful and pleasant fragrance. The tree can reach a maximum height of ten meters and possesses dark green, glossy leaves that emit a pleasant scent when crushed. The population of Burmanii trees in Sumatra thrives and plays a significant role in the local vegetation [3].

In addition to being a food flavoring ingredient, cinnamon is used in nutrition and health fields, making it a spice that not only has high economic value but also has extensive

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health benefits [4-5]. Cinnamon is frequently utilized in tea in the form of powder, sticks, or extract [6]. Both gastronomic and therapeutic contexts frequently employ the traditional uses of cinnamon. Cinnamon bark contains chemicals like cinnamaldehyde, eugenol, and kumarin [7-8]. These substances are known to have antioxidant [9], antiaging [10], antiinflammatory [11], anticancer [12], antiparasitic, antimicrobial [13], antifungal, antithelmitic [14] and antibacterial properties [15-16]. Other research suggests that cinnamon bark can help regulate blood sugar levels [7] and even have potential as an anticancer agent. According to studies cinnamon has the potential to regulate blood sugar levels and lower the risk of hyperlipidemia [17–19]. Besides, it can also be used as a skin care [16].

In global trade, Indonesian cinnamon is a valuable and highly competitive export commodity with ever-increasing demand [20]. Indonesia is one of the world's leading producers of cinnamon, competing with countries such as Sri Lanka and Vietnam. Cinnamon bark exports make a significant contribution to the Indonesian economy, especially for people living in cinnamon-producing areas such as Western Sumatra. This cinnamon's economic value makes it an important commodity that continues to develop in terms of both quality and quantity of production [21].

The morphological characteristics of cinnamon plants have been extensively examined by researchers in various beneficial plants from multiple regions and in both qualitative and quantitative studies. However, the morphological characteristics of cinnamon plants from Western Sumatra remain largely unexplored. The research aims to study the morphological characteristics of cannabis plants in the Agam District, which is one of Sumatra's cinnamon leather production centres. The knowledge of morphological characteristics and biodiversity will play an important role in the selection and examination of desirable characteristics for breeding purposes [22].

2 Method

2.1 Experiment site and plant materials

The location of the research is at the production centre of cinnamon in Agam district of West Sumatra Province, which will be carried out in December 2023. The population's potential number of cinnamon plants is 1500–2000 trees. The plant sample observed at the site consists of 30 trees with a growing age of 14 years in 672 meter above sea level (0°25'13.3"S 100°15'07.3"E). The size of cinnamon plants cultivated by farmers range from 2 m x 2 m to 4 m x 4 m. The materials used in this study are populations of cinnamon, plastics, and labels. The tools used in this study include measuring instruments, digital cameras, GPS, knives, scissors, and other aids.

2.2 Exploration of cinnamon plants

The exploration activity begins with coordination with the local government and other sources of the local population. Research using survey methods with purposive sampling. All varieties are assigned collection numbers and include documented information about the habitat, elevation (in meters above sea level), condition, history, and other relevant facts. We sampled trees that had recovered from pest disease and were over 10 years old. We observed the plot at a distance of 0.5 ha.

2.3 Morphological character identification

Morphological character identification is done against qualitative and quantitative character [23-24]. Characterization refers to, among other things, observations of the length of the canopy, the shape of the leaf, the shoots, the color of the flower, leaf length, sheet width, fruit lengths, and fruit diameter. The characterization process involves conducting observations and measurements directly in the field.

2.4 Data Analysis

The data obtained is presented in the form of tables and analyzed descriptively. Plant descriptions are made based on both qualitative and quantitative plant morphological characteristics. Quantitative character data is calculated as averages and standard deviations.

3 Result

Plant height, canopy area, trunk circle, thick skin, leaf length and breadth, length and width of flower chains, and fruit lengths and diameters are all part of the quantitative measurements of cinnamon plants (Table 1). The plant height ranges from 10 to 17 m with average 13.36 m, and the canopy area is between 4.87 m and 8.97 m with average 6.54 m. The average stem circle measures 61 to 80 cm in size with average 70.65. The thickness of the bark varies between 0.24 and 0.66 mm with average 0.58 mm. The leaves have a length of 8.3 to 113.00 cm with average 10.15 cm and a width of 2.3 to 3.83 cm with average 3.92 cm (Table 1).

Table 1. Quantitative character of Agam cinnamon

	Traits	Average ± SD	Minimum	Maximum
Tree	Plant height (m)	13.36 ± 1.82	10.00	17.00
	Canopy area (m)	6.54 ± 1.34	4.87	8.97
	Trunk circumference (cm)	70.65 ± 7.63	61.00	80.00
	Thickness of bark (mm)	0.58 ± 0.03	0.24	0.66
Leaf	Leaf length (cm)	10.15 ± 1.62	8.30	13.00
	Leaf width (cm)	3.92 ± 0.81	2.30	3.83
Flowers	Flower arrangement length (cm)	11.53 ± 0.38	11.00	12.00
	Width of the flower arrangement (cm)	10.78 ± 0.84	10.50	12.00
Fruits	Fruit length (mm)	1.20 ± 0.02	1.06	1.24
	Fruit diameter (mm)	0.86 ± 0.19	0.76	0.91

Direct observation of the morphological character of cinnamon plants, including the character of the stems, leaves, flowers, and fruits of the cinnamon plant (Table 2), which

exhibit an upright growth habit with one to three main stems. The surface of the stem are brown, with the inner color being redish brown (Figure 1b). The leaves on the cinnamon plant have a lanceolate shape with acute afex and base leaf. The color of the cinnamon plant's leaves varies from young to old. The young leaves exhibit a red color, which gradually transitions to a yellowish-red hue with a hint of green, while the older leaves display an aged green hue (Figure 1a).

The cinnamon plants in this population exhibit an annual blooming and fruiting cycle during the months of May and June, with flower-shaped flower arrangements (Figure 1c). The immature fruit of the cinnamon tree is green, but it acquires a blackish-purple color as it reaches maturity. Black-purpelish fruit is one of the characteristics of a good cinnamon seed (Figure 1d). To harvest the straw for seed, the farmers use special nets placed under the trees. Farmers have used healthy, high-quality seeds from healthy trees, creating opportunities for future growth and sustainable cinnamon production.

Table 2. Qualitative character of Agam Cinnamon

No	Parameter	Characteristics
1	Growth habit	Upright
2	Trunk	Single – triple
3	The surface of the bark	Brown
4	Inner bark color	Reddish brown
5	Leaf shape	Lanceolate
6	Leaf apex	Acute
7	Leaf base	Acute
8	Young leaf color	Greenish yellow
9	Old leaf color	Green – dark green
10	Shoot color	Red
11	Types of flower	Panicles
12	Flower color	White-cream
23	Fruit color	Blackish-purple

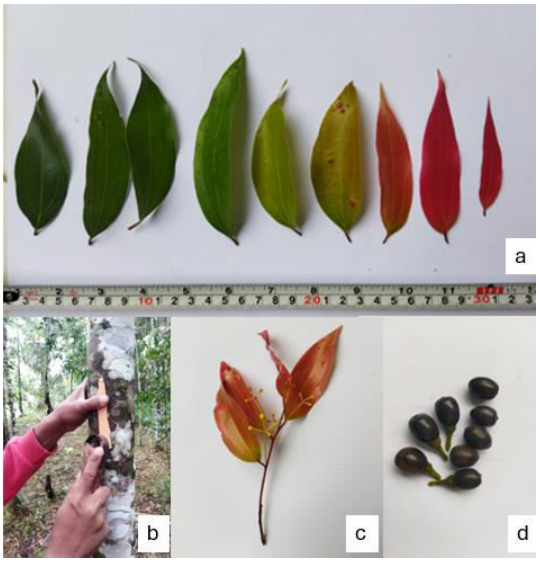

Fig. 1. Leaf (a), stem (b), flowers and young leave (c), and fruit morphology (d) of Agam Cinnamon

4 Discussion

The morphological characteristics of this cinnamon are interesting to study because they can provide important information about how these plants adapt to the local environment [25]. Diversity in the morphological level of the cinnamon plant population will be indicated by both qualitative and quantitative characteristics. For an extended period of time, the primary objective of plant types has been to enhance their morphological characteristics [22]. Cinnamon plants have varied morphological characteristics [1]. The cinnamon tree's morphological characteristics in Agam regency show similarities with those in Jambi, including plant habit, leaf shape, shoot color, apex folly, leap base, and flower type [26].

Development of morphological index has been done to facilitate the identification of several varieties of cinnamon. In the seed, the leaf shape is used to prevent the occurrence of seed mixing and to identify seeds of the best variety of cinnamon plants. In general, cinnamon has a lanceolate leaf shape, an ovate lanceolat or an elliptic shape like the cylon cinnamon [24]. Cinnamon leaves have varying sizes depending on the leaves used, so the one used is a perfectly open leaf with a green leaf color and is in the 5^{th} position of the leaf shoots. Leaf architecture is a valuable tool for distinguishing character variations across plants due to its genetic stability [27]. Naturally the cinnamon flower is crosspolination, identified as protegynous dichogami. The flower's opening cycle is completed within a 12-hour period, with anthers becoming dehiscent in the evening and in the morning of the next day. This allows for crossings between plants [28].

The most important thing in measuring potency is the thickness of the cinnamon bark from which it is harvested. *Cinnamomum verum* from Sri Lanka has a barak thickness ranging from 0.60 mm to 1.77 mm [29,30], and at different altitudes, the bark thickness of *Cinnamomum burmanni* in Jambi varies between 1.13 mm and 6.85 mm [26]. Two methods are employed to harvest cinnamon bark: the first method involves harvesting the cane exclusively with its skin, while the second method involves cutting. The second method is

employed to simplify the harvesting process when the diameter of the cinnamon plants is sufficiently enormous.

5 Conclusion

The study concluded that there were notable variations in the characteristics of cinnamon trees, including their height ranging from 10 to 17 meters and stem diameters ranging from 19.43 to 25.48 cm. The thickness of the bark is 0.24 to 0.66 cm. Leaves also showed variations in shape, size, and color across individuals. Branch structures exhibited no differences in branching levels or leaf distribution. The cinnamon tree population in Agam Regency exhibits morphological diversity and promising cinnamon production, which is essential for conservation and breeding efforts to enhance productivity and sustain local ecosystems.

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