MORPHOLOGICAL CHARACTERISTICS (QUALITATIVE AND QUANTITATIVE) OF CASSAVA PLANTS IN SERDANG BEDAGAI DISTRICT, NORTH SUMATRA

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ABSTRACT

Serdang Bedagai Regency is the largest cassava production center in North Sumatra with a production of 545,881.3 tons of cassava, but until now there was no quantitative data on the differences in morphological characteristics in the Serdang-Bedagai district. This study aimed to determine cassava diversity based on morphological traits in the lowlands of the Serdang Bedagai district of North Sumatra. The method used in this study was a survey method, namely the identification of morphological characteristics of cassava. Morphological features observed were qualitative and quantitative features. Observations were made on cassava plants planted by farmers in the Serdan Bedagai district of North Sumatra. The cassava was old enough to be harvested, healthy, and free of pests and diseases. The lowlands of Serdang Bedagai Regency have seven species: Klanting Putih (G1), Klanting Merah (G2), Jakarta (G3), Adira (G4), Malaysia (G5), Gendruwo (G6), Gendruwo Hitam (G7), Thailand (G8), dan Kuning (G9). There are differences and similarities in morphological characteristics among the nine cassava species. A relatedness analysis based on 31 qualitative and quantitative morphological features indicated the existence of plant-related groups among cassava.

Keywords: Characterstics of Cassava, Morphological, Qualitative, Quantitative

INTRODUCTION

According to the Center for Statistics, North Sumatra majority the fifth out of 34 provinces in Indonesia as a cassava producer in 2020. Of Indonesia's total production of 21,801,415 tons, Serdang Bedagai Province is the largest cassava producer in North Sumatra, with 545,881.3 tons of cassava produced in the lowlands.

Cassava is a plant that requires certain climatic requirements. Cassava plants require temperatures between 18^0C – 35^0C. At temperatures below 10^0C, the growth of cassava plants will be stunted. The air humidity needed for cassava is 65%. However, for maximum production of cassava plants requires certain conditions, namely in the tropical lowlands (Sundari, 2010).

In general, cassava plants that grow in the lowlands of North Sumatra are found in Serdang Bedagai Regency with an altitude of 5 m – 120 m above sea level. The study of the identification and characterization of local food resources is one of the efforts to identify the wealth of local food sources and to find out the strategies of local communities to provide food throughout the year. This effort is fundamental to understanding the actual condition of the wealth of local food resources and the culture of local communities in managing and utilizing their local food resources (Purwanto, 2011).

Cassava is grown commercially in almost all parts of North Sumatra, especially in Toba Serdang Bedagai Regency, but so far there has never been quantitative data on the differences in its morphological properties. Therefore, it is necessary to carry out identification research based on morphological characters which are very useful for knowing the various types and varieties of cassava to obtain information about the morphology and yield potential of each type of cassava based on its growing environment.

LITERATURE REVIEW

Based on its amylose content, cassava is divided into 2 groups, namely friable cassava (amylose content more than 20%) which is physically characterized when the brown epidermis peels off and the thick skin is easily peeled off, and rubbery cassava (amylose content less than 20%) which marked when the brown epidermis is not peeled off (sticky to the thick skin) and the thick skin is difficult to peel (Prabawati, 2011).

Mature cassava plants can reach 1 to 2 meters high, although some cultivars can reach up to 4 meters high. Cassava stems are cylindrical with a diameter ranging from 2 to 6 cm. Stem color varies widely, from grayish-white to brown or dark brown. The stem of this plant is woody with a wide cork (pith). Each stem produces an average of one node (node) per day at the start of its growth, and one node per week thereafter. Each book unit consists of a book where the leaves and book segments (internodes) are attached. Internode length varies depending on genotype, plant age, and environmental factors such as water and light availability. The nodes are short in drought conditions and long if the environmental conditions are suitable, and very long if there is a lack of light (Ekanayake *et al*, 1997).

Cassava grows optimally at an altitude between 10 – 700 meters above sea level. Suitable soil is soil that has a crumb structure, is loose, neither clay nor porous, besides that it is rich in nutrients. Suitable soil types are alluvial, latosol, red-yellow podzolic, Mediterranean, Grumosol and andosol. Meanwhile, the required pH is between 4.5 – 8 and the ideal pH is 5.8. The required rainfall is between 1,500 – 2,500 mm/year. The optimal air humidity for plants is between 60% - 65%. The minimum air temperature is 10 ºC. The need for sunlight is about 10 hours each day and live without shade (Effendi, 2002).

The scope of plant taxonomy includes identification, classification, and description. The taxonomy is based on observable, quantifiable, quantifiable, and constrained characters. Until now morphology is the main character in taxonomy. Flower morphology includes shape, color, number, and organization of its parts, while vegetative morphology includes branching, growth, stem texture and arrangement, size, and leaf shape. Knowledge of morphology and terminology is used in identification. Pencandraan, a systematic description of the shape and composition of the plant body is very important in the naming of a new taxon (Suratman *et al*, 2000).

METHODS

This research was conducted in Serdang Bedagai District, North Sumatra Province. The selection of sampling locations was based on secondary data on the area of cassava plantations and the highest production of each village from Serdang Bedagai District Statistics. Three districts were selected as research locations, namely Bintang Bayu District, Dolok Masihul District, and Sei Rampah District. Several villages were selected from the 3 sub-districts, namely Penambean Village in Bintang Bayu District. Kampung Tengah Expansion Village and Kampung Padang Village in Dolok Masihul District. Pergulaan Village and Belidaan Village in Sei Rampah District.

The method used in this study was a survey method, namely identifying the morphological characteristics of cassava. Direct surveys were conducted in all villages where cassava was found. Data collection was carried out on cassava with different types at each location. Data collection was carried out by observing the samples based on the selected cassava description guidebook Selected Morphological and Agronomic Descriptors for the Characterization of Cassava (Fukuda et al 2010). The morphological characters observed were qualitative and quantitative.

The morphological parameters include leaf tip color, mid-leaf shape, petiole color, leaf color, number of leaf lobes, leaf lobe length (cm), leaf lobe width (cm), lobe margin, petiole or

petiole length (cm), leaf vein color, petiole orientation, flowering, stem cortex color, stem epidermis color, stem exterior color, the distance between leaf scars (cm), the growth habit of the stem, fruit, seeds, plant height (cm), height to the first branch (cm), plant shape, root stalk level, root shape, root external color, root parenchyma color, root cortex color, tuber length (cm), tuber diameter (mm), number of tubers/plant, and tuber weight (kg).

RESULTS AND DISCUSSION

Morphological characteristics of cassava in Serdang Bedagai Regency

Nine types of cassava were found in Serdang Bedagai Regency with different morphological characteristics, including White Clan (G1), Red Clan (G2), Jakarta (G3), Adira (G4), Malaysia (G5), Gendruwo (G6), Gendruwo Hitam (G7), Thailand (G8), and Yellow (G9). The differences in the morphology of the nine cassava are presented in Table 1, Table 2, and Table 3, respectively by the district.

Table 1. Morphology of cassava G1 and G2 in Bintang Bayu District, Serdang Bedagai.

Parameters	G1	G2
Leaf shoots color	Purplish green	Purplish green
Middle leaf shape	Obovate lanset	Obovate lanset
Leaf stalk color	Reddish green	Red
Leaf color	Dark green	Dark green
Number of leaf lobes	Seven	Seven
Leaf lobe length (cm)	15.7	20.3
Leaf lobe width (cm)	22.8	33.8
Lobe rim	Smooth	Smooth
Leaf stalk length (cm)	30.1	30.1
Leaf vein color	Green	Green
Petiole orientation	Tilt up	Tilt down
Flowering	None	None
Stem cortex color	Light green	Light green
Stem epidermis color	Dark chocolate	Dark chocolate
Trunk exterior color	Silver	Greenish yellow
Distance between leaf scars (cm)	4.1	1.7
Stem growth habit	Zig-zag	Straight
Fruit	None	None
Seed	None	None
Plant height (cm)	15.8	183.1
High to the first branch (cm)	-	-
Plant shape	Cylindrical	Cylindrical
Plant root peduncle level	Mix	Sessil
Root shape	Irregular	Cylinder
Root external color	Light brown	Dark brown
Root parenchyma color	Cream	Yellow
Root cortex color	Yellow	Yellow
Tuber length (cm)	26.3	21.23
Tuber diameter (mm)	40.93	39.76

Number of tubers/plant	9	9
Average tuber weight (kg)	1.5	1.4

Table 2. Morphology of Cassava G3 and G4 in Dolok Masihul District, Serdang Bedagai.

Parameters	G3	G4
Leaf shoots color	Purplish green	Purple
Middle leaf shape	Elips- lanset	Elips- lanset
Leaf stalk color	Red	Red
Leaf color	Dark green	Dark green
Number of leaf lobes	Seven	Nine
Leaf lobe length (cm)	25.62	16.86
Leaf lobe width (cm)	28.46	26.74
Lobe rim	Curve	Smooth
Leaf stalk length (cm)	19.72	24.04
Leaf vein color	Green	Reddish green
Petiole orientation	Irregular	Tilt down
Flowering	None	Exist
Stem cortex color	Light green	Light green
Stem epidermis color	Light brown	Dark chocolate
Trunk exterior color	Greenish yellow	Grey
Distance between leaf scars (cm)	2.68	2.28 (Short)
Stem growth habit	Straight	Straight
Fruit	None	Exist
Seed	None	Exist
Plant height (cm)	332.12	230.6
High to the first branch (cm)	-	-
Plant shape	Cylindrical	Cylindrical
Plant root peduncle level	Sessil	Sessil
Root shape	Cylinder	Irreguler
Root external color	Light brown	Light brown
Root parenchyma color	White	White
Root cortex color	Yellow	Yellow
Tuber length (cm)	28	37
Tuber diameter (mm)	61.3	52.7
Number of tubers/plant	13	11
Average tuber weight (kg)	4.2	4.82

Table 3. Morphology of Cassava G4, G5, G6, G7, G8, and G9 in Sei Rampah District, Serdang Bedagai.

Parameters	G4	G5	G6	G7	G8	G9
Leaf shoots color	Purple	Purple	Purplish green	Purplish green	Purple	Purplish green
Middle leaf shape	Elips- lanset	Egg round	Long oval	Egg round	Obovate lanset	Ogebovate lanset

Leaf stalk color	Red	Green	Red	Red	Green	Red
Leaf color	Dark green	Dark green	Dark green	Dark green	Dark green	Dark green
Number of leaf lobes	Nine	Nine	Seven	Seven	Nine	Seven
Leaf lobe length (cm)	16.86	14.6	16.3	14.12	12.8	14.84 cm
Leaf lobe width (cm)	26.74	28.8	23.5	24.62	21.6	22.88 cm
Lobe rim	Smooth	Smooth	Smooth	Smooth	Curve	Smooth
Leaf stalk length (cm)	24.04	22.8	17.3	25.48	14.66	15.3 cm
Leaf vein color	Reddish green minus half lobes	Green	Reddish green minus half lobes	Reddish green minus half lobes	Green	Green
Petiole orientation	Tilt down	Tilt down	Tilt up	Irreguler	Irreguler	Horizontal
Flowering	Exist	None	None	None	None	None
Stem cortex color	Light green	Light green	Light green	Light green	Light green	Light green
Stem epidermis color	Dark brown	Dark brown	Dark brown	Light brown	Cream	Dark brown
Trunk exterior color	Grey	Dark brown	Light brown	Light brown	Silver	Grey
Distance between leaf scars (cm)	2.28	2	4.3	2.46	2.4	2.1
Stem growth habit	Straight	Straight	Straight	Straight	Zig-zag	Straight
Fruit	Exist	None	None	None	None	None
Seed	Exist	None	None	None	None	None
Plant height (cm)	230.6	347	335	197	281.6	276.2
High to the first branch (cm)	0	0	38	0	0	64.67
Plant shape	Cylindrical	Cylindrical	Cylindrical	Cylindrical	Cylindrical	Cylindrical
Plant root peduncle level	Sessil	Sessil	Sessil	Sessil	Sessil	Mix
Root shape	Irreguler	Irreguler	Cylinder	Cylinder	Cylinder - cone	Irreguler
Root external color	Light brown	Dark brown	Light brown	Light brown	Cream	Dark brown
Root parenchyma color	White	White	Orange	Yellow	Cream	Yellow
Root cortex color	Yellow	Pink	Yellow	Pink	White	Pink
Tuber length	37	32	43	35.5	15.8	36

(cm)						
Tuber diameter (mm)	52.7	64.7	88.3	48.2	51.1	46.1
Number of tubers/plant	11	15	6	6	11	10
Average tuber weight (kg)	4.82	4.6	6.2	2.3	1.6	2.1

The nine types of cassava were found in different villages and altitudes (Table 4).

Table 4. Names of cassava species, districts, villages and altitudes identified in Serdang Bedagai District.

Types of cassava	District	Village	Altitude (m asl)
G1 (Klanting Putih)	Bintang Bayu	Penambean	117
G2 (Klanting Merah)	Bintang Bayu	Penambean	117
G3 (Jakarta)	Dolok Masihul	Kampung Tengah Perluasan	42
G4 (Adira)	Dolok Masihul	Kampung Padang	70
G5 (Malaysia)	Sei Rampah	Pergulaan	38
G6 (Gendruwo)	Sei Rampah	Pergulaan	21
G7 (Gendruwo Hitam)	Sei Rampah	Belidaan	11
G8 (Thailand)	Sei Rampah	Belidaan	6
G9 (Kuning)	Sei Rampah	Belidaan	11

Discussion

Morphological diversity can be observed based on quantitative and qualitative characteristics. Quantitative character is the character of the measurement results with a certain measuring instrument. Based on the results of the identification of morphological characters, it can be seen that the 9 types of cassava found in 3 subdistricts of Serdang Bedagai Regency, namely Bintang Bayu Subdistrict, Dolok Masihul Subdistrict, and Sei Rampah Subdistrict have different characters, however, there are several cassavas found in one Subdistrict and the village, however, has different characteristics. Quantitative characters used to analyze cassava diversity were the number of lobes on leaves, lobe size, stipule length, stipule size, number of tubers, plant height, tuber weight, and harvest index. Meanwhile, the qualitative characteristics used for the analysis of cassava diversity were leaf, stem, and tuber color, petiole color, leaf veins, stem cortex, stem epidermis, stem branch tips, plant shape, and root shape (Zuraida, 2010).

In the identification and inventory research conducted in Serdang Bedagai Regency, North Sumatra, using a survey method in 9 locations, 9 different types of cassava were obtained based on anatomical and morphological characteristics of leaf shoots, old leaves, petioles, leaf veins, young stems, stems old, tuber outer skin color, tuber inner skin color, and tuber color. Malaysian sweet potato and Adira sweet potato are the most widely cultivated types in Serdang Bedagai Regency.

In the tropics, it is generally characterized by almost uniform climatic conditions. However, the existence of geographical differences such as differences in altitude above sea level (asl) will cause differences in the overall weather and climate in that place, especially temperature, humidity, and rainfall. These elements of weather and climate are mostly controlled by latitude, altitude, distance from the sea, topography, soil type, and vegetation. Low places (lowlands) are characterized by high ambient temperature, air pressure, and

oxygen. At high places (plateaus) it has a lot of influence on decreasing air pressure and air temperature and increasing rainfall. This also affects the differences in the morphological characteristics of cassava-based on external factors at the research location in Serdang Bedagai Regency.

CONCLUSION

There are 9 types of cassava in Serdang Bedagai Regency namely White Klanting (G1) and Red Klanting (G2) which are in Bintang Bayu District, Jakarta (G3), and Adira (G4) which are located in Dolok Masihul District, Malaysia (G5), Gendruwo (G6), Black Gendruwo (G7), Thailand (G8), and Yellow (G9) are in Sei Rampah District. There are differences and similarities in morphological characters among the seven cassava. Analysis of kinship based on 31 qualitative and quantitative morphological characters showed that there was a plant kinship group between cassava. These characters are united by special characters, namely plant shape, leaves and petioles, stem, and tubers.

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