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Morphological Characters of Local Origin Durian (*Durio zibethinus* Murr.) Fruits and Seeds from Central Tapanuli Regency, North Sumatra, Indonesia

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***Abstract*— Most of the diversity resource of durian was reported existing in Central Tapanuli. Due to local durian potential, germplasm needed to obtain information on the potential for superior cultivars. Here, we report our identification of morphology characteristics to the genetic relationship of local durian to determine the best durian. This research applied exploration study, interviews, descriptive, and qualitative identification. Research data were grouped based on similarity values using cluster analysis. Results showed that each local durian from Central Tapanuli had similar morphological characters, especially in the vegetative phase. Characters that show distant genetic relationships are fruit length, fruit diameter and seed weight. Other characters that depict close genetic relationship were the color of the fruit stalks and thorns' presence in the fruit. Based on morphological characteristics, a dendrogram was drawn and formed into three clusters. The present study shows that 75 accessions of durian fruit detected in each location have a relatively close similarity distance. That similarity between durian accessions is influenced by interactions between genetic factors and the environment. This result can also be used for durian conservation aimed at collections as genetic resources to benefit durian breeding in expanding diversity.**

***Keywords*— Central Tapanuli; durian; genetic relationship; morphological characters.**

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I. INTRODUCTION

The genetic diversity of tropical fruit such as durian derived from Indonesia, and be foremost as the eight centres of planting durian in the world [1]. It has been reported that twenty-seven species of durian worldwide, belonging to the seven species, are in Sumatra [2]. Many durian species and cultivars are distinct for the one and another to fruit, fruit flesh, and seeds. The best seeds are expected to be received in fruit production and quality taste in plant breeding.

The durian diversity for germplasm and the species have not been applied optimally. Furthermore, the plant breeding of durian needed to get superior seeds. These problems can be approached with collecting the morphological data information of diversity and species germplasm sources [3]. The exotic and unique plants are the red color of flesh *Durio zibethinus* have been reported in Kalimantan, which identified from morphological characteristics [4]. Recently, the Batuah durian, local species has been reported as a fruit with a strong smell and soft flush texture. *D. kutejensis* have been found with the red flesh durian character due to the cross-pollination natural germplasm [5]. The superior characteristics were difficult to be obtained by cross-pollination mechanisms [6].

Central Tapanuli Regency has a lot of kinds the durian trees, which have been planting from a long time ago by traditional and conventional methods. Therefore, considering the significant role of genetic diversity in breeding programs, exploration, and characterization of durian in Central Tapanuli, was required. This study aimed to determine the morphological characteristics and genetic relationship between durian accessions of local durian (*D. zibethinus* Murr.) from fruits and seeds derived Central Tapanuli Regency, North Sumatra, Indonesia.

II. Materials and Method

Based on durian production from the highest to the lowest, the research was conducted in the three sub-districts of Central Tapanuli Regency: (1) Tukka (2) Sitahuis (3) Kolang. There was a total of 75 sampling sites, as depicted in Fig. 1. The total sample of durian studied is 75 accessions with 25 accessions each from Tukka, Sitahuis and Kolang.

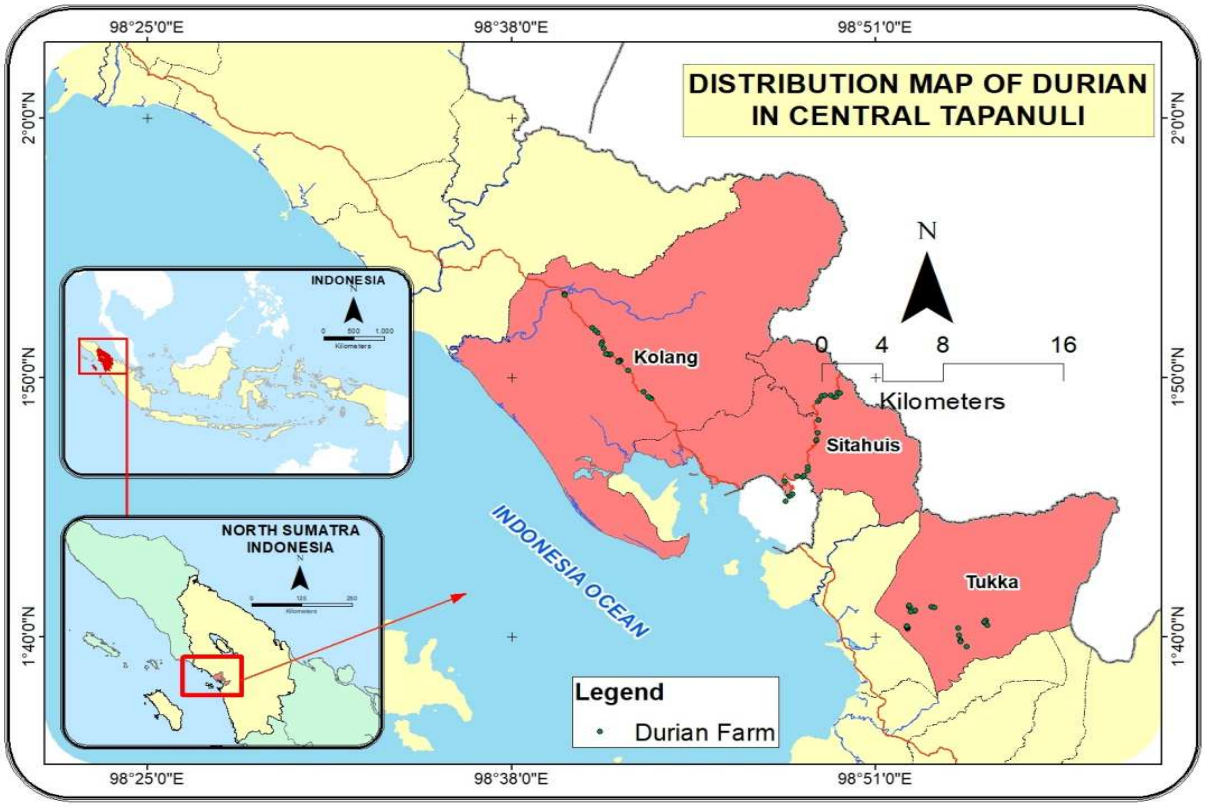

Fig. 1 Distribution map and research locations of durian in 3 sub-districts (Sitahuis. Tukka and Kolang Districts, Central Tapanuli)

A. Exploration and Identification of Characterization

The study was performed using an exploratory method – searching for the existence of durian trees in the 75 sampling sites. Interviews were used for secondary data collection through the same structured questions for each durian farmer. All answers obtained were recorded, processed, identified, and analyzed to obtain primary data through direct observation of the durian trees using the durian description manual from descriptors for durian [7].

The process of identifying plants aims to find out the identity of plants not yet known. Identification can be made in several stages, namely, describing plants and using a list of possibilities. The plant to be identified must be described in all parts of its morphology. The use of references must cover all possibilities that will occur in the identification process. Native or naturalized plants and regional flora can also be used in the process of identifying unknown plants. Identification is made by referring to a precise method and must be under scientific studies. Identification is usually caused by observing and describing morphological characters in detail [8].

Morphological characters of fruit include ripening, grouping model, shape, tip, shape, base shape, length, weight, skin color, fruit flesh taste, fruit flesh color, presence of thorns in the fruit and their shape [7]. Morphological characters of seed include its length, width, weight, shape, and color. Thus, a total of 20 characters have been observed in this study, as summarized in Fig. 2. Quantitative character identification aims to obtain information about the characteristics of an individual to distinguish one from another.

B. Data Analysis

Data of 21 qualitative and quantitative characters were transformed into binary data. An analysis of genetic relationship was performed using the program IBM SPSS (Statistical Package for the Social Sciences) version 21 with cluster analysis to determine the level of genetic relationship between genotypes of each identified plant [9]. Cluster analysis is used to group observational data based only on information found in the data, where the data must describe observations and their relationship, then display as dendrogram [10].

III. Result and Discussion

A. Results of interviews with relevant agencies and community

Central Tapanuli Regency is one of North Sumatra Province's regencies located in the West Region of Sumatra Island. Results were based on interviews with the heads of the three sub-districts that studied Central Tapanuli Regency, Agriculture Office of Central Tapanuli Regency, and the community where durian plants grow naturally on their land. Farmers do not know the origin of durian seedlings as they are plants left by their parents. Information obtained stated that

the durian plant characteristics are unknown, and the collection of durian germplasm has never been carried out. Thus, there are neither cultivation techniques for developing durian plants in terms of rejuvenation by using high-quality and cross-seeded seeds, nor intensive maintenance.

Results of interviews conducted with farmers revealed that most farmers derived their primary income from rubber plantations, sea products and rice products, while durian only earned for them side income. Usually, farmers sell durian fruit to collectors per piece and not by sorting and welding; hence, the fruit price is lower. It is more profitable to sell them directly to consumers.

The habit sale durian to consumers usually when the seasonal, market days, and the highway edge. However, not all farmers do so because: (1) They have limited time and priorities jobs for food crops and plantations. (2) Distance between the village and market (3) Limited transportation facilities for them [11].

B. Morphological Characters of Durian in Central Tapanuli

The results of durian characterisation in Tukka, Sitahuis and Kolang sub-districts were found in 75 accessions. Diversity of morphological characters to distinct accessions included the fruit's rind color, flesh color, seed form, seed color, and taste using an organoleptic test (Table I).

TABLE I
MORPHOLOGICAL DIVERSITY OF DURIAN IN CENTRAL TAPANULI

Site	Accession Code	Village Name	Rind color	Flash Color	Organoleptic	Seed Form	Seed Color
Tukka sub-district	A1	Hutanabolon	Yellowish green	Creamy white	Sweet	Oval	Brown
	A2		Brownish green	Creamy white	Sweet	Ellipse	Brown
	A3		Pink	Creamy white	A little sweet	Ellipse	Brown
	A4		Brownish green	Creamy white	Sweet	Oval	Brown
	A5		Green	Creamy white	Sweet	Ellipse	Brown
	A6	Sigiring-giring	Yellowish green	Yellow	Sweet	Ellipse	Tawny
	A7		Pink	Creamy white	Sweet with a bitter taste	Ellipse	Tawny
	A8		Pink	Creamy white	Sweet	Oval	Tawny
	A9		Pink	Creamy white	Tasteless	Rounded	Brown
	A10		Orange-yellow	Creamy white	Sweet with a bitter taste	Rounded	Tawny
	A11	Sahit Ni Huta	Greeny Yellow	Creamy white	Sweet	Oval	Tawny
	A12		Brownish green	Yellow	Bitter Sweet	Ellipse	Brown
	A13		Brownish green	Creamy white	Sweet	Rounded	Tawny
	A14		Brownish green	Creamy white	A little sweet	Obovoid	Tawny
	A15		Green	Creamy white	Sweet	Oval	Tawny
	A16	Tukka	Green	Yellow	Sweet	Oval	Tawny
	A17		Brownish green	Creamy white	A little sweet	Oval	Tawny
	A18		Brownish green	Creamy white	Sweet	Rounded	Tawny
	A19		Pink	Creamy white	Sweet	Oval	Tawny
	A20		Pink	Creamy white	Sweet	Oval	Brown
Tukka Sub-district	A21	Sipange	Yellowish green	Yellow	Sweet with a bitter taste	Ellipse	Tawny
	A22		Green	Creamy white	Sweet	Oval	Tawny
	A23		Brownish green	Creamy white	Sweet	Oval	Brown
	A24		Brownish green	Creamy white	Sweet	Ellipse	Tawny
	A25		Brownish green	Creamy white	Sweet	Oval	Tawny
Sitahuis sub-district	A26	Simaninggir	Brownish Yellow	Creamy white	Sweet	Oval	Brown
	A27		Greeny Yellow	Creamy white	Sweet with a bitter taste	Obovoid	Brown
	A28		Brownish green	Creamy white	Sweet	Rounded	Tawny
	A29		Green	Yellow lemon	Bitter Sweet	Rounded	Brown
	A30		Brownish green	Creamy white	Sweet	Rounded	Tawny
Sitahuis sub-district	A31	Bonan Dolok	Brownish green	Creamy white	Sweet	Obovoid	Tawny
	A32		Brownish green	Creamy white	Sweet	Obovoid	Brown
	A33		Green	Creamy white	Sweet	Ellipse	Tawny
	A34		Green	Creamy white	Sweet	Obovoid	Tawny
	A35		Pink	Yellow	Bitter Sweet	Ellipse	Brown
	A36	Rampah	Green	Creamy white	Sweet	Ellipse	Brown
	A37		Green	Creamy white	Sweet	Rounded	Tawny
	A38		Green	Yellow	Sweet	Ellipse	Tawny
	A39		Green	Yellow	Sweet	Ovate	Tawny
	A40		Brownish green	Creamy white	Sweet	Oval	Brown
	A41	Mardame	Green	Creamy white	Sweet	Ellipse	Brown
	A42		Brownish Yellow	Creamy white	Sweet	Obovoid	Brown
	A43		Green	Yellow	Sweet	Oval	Brown
	A44		Green	Yellow	Sweet	Ellipse	Brown
	A45		Pink	Creamy white	Bitter Sweet	Ellipse	Tawny
	A46	Nauli	Green	Yellow	Bitter Sweet	Oval	Tawny
	A47		Green	Yellow	Bitter Sweet	Ellipse	Tawny
	A48		Brownish green	Creamy white	Bitter Sweet	Oval	Brown
	A49		Green	Yellow	Sweet	Oval	Tawny
	A50		Green	Creamy white	Sweet	Oval	Brown

TABLE I (CONTINUED)

Site	Accession Code	Village Name	Rind color	Flash Color	Organoleptic	Seed Form	Seed Color
Kolang sub-district	A51	Unte Mungkur IV	Green	Creamy white	Sweet	Oval	Tawny
	A52		Greeny Yellow	Creamy white	Sweet	Obovoid	Tawny
	A53		Green	Yellow	Sweet	Obovoid	Tawny
	A54		Green	Yellow	Bitter Sweet	Oval	Tawny
	A55		Pink	Creamy white	Bitter Sweet	Oval	Tawny
	A56	Unte Mungkur III	Green	Creamy white	Bitter Sweet	Ellipse	Tawny
	A57		Green	Creamy white	Sweet	Ellipse	Brown
	A58		Green	Creamy white	Bitter Sweet	Obovoid	Tawny
	A59		Green	Yellow	Bitter Sweet	Ovate	Tawny
	A60		Yellowish green	Creamy white	Sweet	Obovoid	Tawny
	A61	Unte Mungkur II	Green	Creamy white	Bitter Sweet	Oval	Tawny
	A62		Green	Creamy white	Bitter Sweet	Ellipse	Tawny
	A61	Unte Mungkur II	Green	Creamy white	Bitter Sweet	Oval	Tawny
	A62		Green	Creamy white	Bitter Sweet	Ellipse	Tawny
	A63		Pink	Creamy white	Sweet	Ellipse	Tawny
	A64		Brownish green	Creamy white	Sweet with a bitter taste	Obovoid	Tawny
Kolang sub-district	A65		Brownish green	Creamy white	Sweet with a bitter taste	Ellipse	Tawny
	A66	Unte Mungkur I	Green	Creamy white	Sweet	Oval	Tawny
	A67		Brownish green	Yellow	Bitter Sweet	Oval	Brown
	A68		Brownish green	Creamy white	Bitter Sweet	Oval	Tawny
	A69		Brownish green	Creamy white	Sweet	Ellipse	Tawny
	A70		Brownish green	Creamy white	Bitter Sweet	Ellipse	Tawny
	A71	Pasar Onan Hurlang	Brownish green	Creamy white	Bitter Sweet	Oval	Tawny
	A72		Pink	Creamy white	Bitter Sweet	Ellipse	Tawny
	A73		Green	Yellow lemon	Bitter Sweet	Ellipse	Tawny
	A74		Brownish green	Creamy white	Bitter Sweet	Ellipse	Brown
	A75		Green	Creamy white	Bitter Sweet	Ellipse	Brown

Based on Table I, there are seven diverse types of durian's rind color, namely, green, yellowish-green, brownish-green brownish yellow, greenish-yellow, orange-yellow and pink, as displayed in Fig. 2 there were three diverse types of fruit flesh color, namely, creamy white, yellow and yellow lemon, as shown in Fig. 2, there were five different types of seed form, namely, oval, ellipse, obovoid ovate and rounded while, there were only two types of seed color, brown and tawny as shown in Fig. 2.

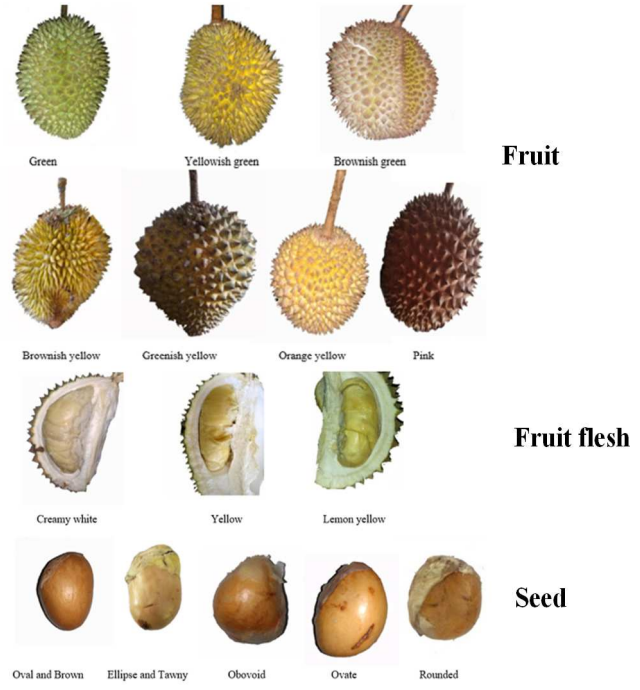

Fig. 2 The phenotypic appearance differences (character of the fruit, fruit flesh, seed) in 75 accessions of durian in Central Tapanuli District

Results of the identification of all durian plants showed diversity between their accessions. The occurrence of the variations is related to quantitative characters. It can be understood that quantitative character is controlled by several minor genes and is more influenced by environmental factors. In this study, diversity in durian populations based on fruit and seed characters is assumed to be caused by environmental factors or adaptation to the environment. Cultivated durian may experience mutations that lead to new genotypes resulting from local environmental adaptations.

However, suppose it is caused by adaptation to not the homogeneous environment. In that case, it takes quite a long time for the formation of diversity that is not extensive as the environment is not very influential [12]. Suppose the durian diversity is caused by the presence of different tastes, namely, sweet, a little sweet, sweet with a bitter taste after it, bittersweet and tasteless, even though only in small amounts. It is possible to cross-breed with other durian trees. However, it also takes a long time to form new genotypes to get a wide diversity in the 75 durian populations, as in the study site. Currently, durian trees cultivated by farmers are all propagated using seeds originating from different locations and parent trees and then planted in different environments so that within decades there can be seed segregation.

Segregation can cause diversity due to the formation of gametes, which only have half of the parent genes so that there is diversity. This segregation may create wide durian diversity in the three sub-districts based on fruit and seed characters. Therefore, the difference seen in durian may be caused by gene segregation in durian seeds [13]. Table II showed the qualitative characters in 75 accessions of durian originating from the three sub-districts of Central Tapanuli, North Sumatra. The homogeneous characterization (standard

deviation = 0) on the character type of fruit stalk colour is brown, and thorns in fruit were available.

TABLE II
QUALITATIVE CHARACTERS OF DURIAN

Morphological Characters	Mean ± SD
Fruit maturation	1.33 ± 0.47
Fruit grouping	2.45 ± 0.70
Fruit shape	3.61 ± 1.92
Fruit tip shape	2.51 ± 1.09
Fruit base shape	3.44 ± 1.32
Fruit stalk length	1.72 ± 0.45
Fruit stalk color	3.00 ± 0.00
Fruit thorn	1.00 ± 0.00
Thorn shape	5.15 ± 1.95
Fruit weight	1.81 ± 0.51
Fruit skin color	2.64 ± 2.04
Fruit flesh taste	2.52 ± 0.92
Fruit flesh color	1.41 ± 0.79
Seed shape	2.76 ± 1.16
Seed color	1.34 ± 0.48

The character type controlled with oligogenic. This result is consistent with the literature [14], which states that plant characters can be divided into two parts, namely, qualitative, and quantitative. Qualitative characteristics controlled by several genes. The monogenic controlled by one gene or oligogenic. Where is characterized by the discontinuous distribution of phenotypes [14]. The effect of individual genes is easily recognized; the way of inheritance is simple – not or little influenced by the environment. Quantitative characters are controlled by many genes (polygenic). Each one has little effect on the trait expression, largely influenced by the environment [14].

A. Phenotype Diversity

Based on morphological characters of 75 durian accessions originating from three sub-districts in Central Tapanuli Regency, the phenotype diversity criteria can be seen in Table III.

TABLE III
PHENOTYPE DIVERSITY OF DURIAN ACCESSIONS IN CENTRAL TAPANULI REGENCY

Code	Morphological Characters					Code	Morphological Characters				
	Fruit length (cm)	Fruit diameter (cm)	Long seed (cm)	Wide seed (cm)	Weight of seeds (g)		Fruit length (cm)	Fruit diameter (cm)	Long seed (cm)	Wide seed (cm)	Weight of seeds (g)
A1	17	9.57	5	3	16.87	A39	15	9.70	4.3	3.8	13.80
A2	17	11.05	4	2.5	9.27	A40	23	10.22	5.5	3.8	22.20
A3	12	9.57	3.5	2.5	3.81	A41	16	9.57	5.5	4.5	23.00
A4	18	10.09	4	2.5	8.30	A42	14	9.84	3.2	3	4.98
A5	20	10.34	2.34	11	20.16	A43	13	9.70	5.5	3.7	23.12
A6	22	10.34	4.6	4	23.26	A44	23	9.84	4.7	3.8	23.32
A7	11.5	9.77	3.5	2.7	4.92	A45	17	11.05	5	3.5	21.28
A8	15	9.70	5	2.5	13.11	A46	19.5	10.09	4.5	4	18.26
A9	16	9.70	3	3.5	13.92	A47	22	10.58	4.5	2.5	19.02
A10	25	9.84	3.5	3.5	14.87	A48	23	9.96	4.5	4	18.05
A11	25	11.39	4.5	2.5	11.22	A49	22	10.09	5	3.8	21.14
A12	18	11.72	4	2	5.00	A50	22	9.96	5	3.2	19.87
A13	20	11.72	4.5	2.5	10.00	A51	20	9.96	4.7	3.4	23.30
A14	15	11.28	5	3	10.00	A52	18.5	9.96	5	3.5	22.36
A15	22	10.34	3.8	2.5	5.00	A53	22	9.96	5.3	3.3	17.88
A16	13	10.58	6	3.5	20.00	A54	19	9.84	4.5	3.5	11.71
A17	14	10.58	4	3	16.85	A55	16	9.84	5.2	3.3	18.95
A18	11	9.70	3	2.5	12.03	A56	17	9.70	5	4	19.08
A19	14	9.84	5.5	2.5	17.00	A57	18.6	9.84	5	3.2	18.86
A20	16	9.84	5.5	3	10.00	A58	22.4	9.70	5	3.5	17.03
A21	15	9.57	4	2	1.83	A59	17	9.84	5	3.4	22.03
A22	18	9.84	4	3	9.90	A60	18	9.96	5	3.5	19.00
A23	16	9.70	5	4	21.70	A61	17	9.70	5	3	19.76
A24	18	9.70	3	3	6.91	A62	17	10.09	5.5	4	28.57
A25	14	9.70	5	3	16.88	A63	15	10.70	5	3	6.80
A26	18	9.57	3	2	6.25	A64	17	9.96	6	3.5	17.20
A27	17	9.70	3.5	2.5	4.90	A65	22	10.70	4.5	2	5.09
A28	22	9.84	5	4.5	14.00	A66	18	9.96	4.6	3.3	17.93
A29	25	9.84	5	5.2	15.30	A67	23	10.34	5.5	3.5	19.26
A30	16	10.09	5.5	5	16.00	A68	15	10.58	5	3	22.14
A31	25	10.09	5.5	4.8	16.18	A69	15.5	10.70	4.5	3.5	19.90
A32	20	9.57	5	3	12.00	A70	18	10.34	5	3.9	28.31
A33	18	9.84	4	2.5	10.00	A71	16	10.34	4.5	3.5	18.65
A34	22	9.84	4.5	4	20.00	A72	17	10.34	5	3.3	17.49
A35	12	9.96	5.5	5	17.00	A73	22.5	10.46	5.3	4	29.22
A36	21	10.70	4.5	4	20.00	A74	19	10.58	3	2.2	7.23
A37	22	11.05	4.5	4	20.00	A75	21	10.46	4.5	2	2.94
A38	20	10.34	4.5	4	26.20						
σ^2p	11.07	0.25	0.60	0.54	43.53	σ^2p	11.07	0.25	0.60	0.54	43.53
$Sd\sigma^2p$	3.33	0.50	0.77	0.74	6.60	$Sd\sigma^2p$	3.33	0.50	0.77	0.74	6.60
$2Sd\sigma^2p$	6.65	1.01	1.55	1.48	13.20	$2Sd\sigma^2p$	6.65	1.01	1.55	1.48	13.20
Criteria	Large	Large	Narrow	Narrow	Large	Criteria	Large	Large	Narrow	Narrow	Large

Based on Table III, it is known that quantitative characters of 75 accessions of durian from three sub-districts in Central Tapanuli Regency, North Sumatra, have different diversity. Characters classified as broad include the fruit's length and

diameter and the weight of the seed. While characters classified as narrow are other widths of seed length and width of the seed. This result is consistent with the literature [15], which states that populations that have narrow genetic diversity identify that individuals in them have relatively uniform appearances.

The wide diversity of characters makes it easy to carry out their selection. The existence of genetic diversity will then affect the variety of phenotypes due to the interaction between genetics and the environment so that if plants are planted in different environments, it will not necessarily provide the same appearance despite having genetic similarities. The amount of genetic diversity of a character is influenced by the gene's constitution controlling the character.

B. Genetic Relationship

Table IV shows the genetic relationship of 75 accessions of durian in Central Tapanuli Regency seen from the dissimilarity matrix.

TABLE IV
GENETIC RELATIONSHIP OF 75 ACCESSIONS OF DURIAN IN CENTRAL TAPANULI DISTRICT

No.	Genetic Relationship		Dissimilarity Value	No.	Genetic Relationship		Dissimilarity Value
1	A4	A26	3.120	39	A5	A44	30.953
2	A11	A63	3.958	40	A12	A21	31.014
3	A37	A62	4.054	41	A7	A20	32.920
4	A13	A33	4.924	42	A7	A26	33.100
5	A2	A33	5.131	43	A4	A59	33.950
6	A1	A40	6.199	44	A3	A70	34.106
7	A2	A4	7.995	45	A14	A45	34.945
8	A22	A68	8.871	46	A3	A56	35.998
9	A28	A29	9.007	47	A14	A44	36.902
10	A51	A71	10.807	48	A7	A66	37.812
11	A4	A34	11.991	49	A36	A59	38.963
12	A5	A68	12.885	50	A3	A54	39.935
13	A8	A26	13.097	51	A28	A42	40.979
14	A11	A56	13.946	52	A16	A43	41.791
15	A16	A60	14.008	53	A19	A29	42.884
16	A26	A71	14.939	54	A1	A47	43.813
17	A2	A70	15.004	55	A7	A58	44.966
18	A33	A71	15.921	56	A7	A74	45.502
19	A4	A60	16.003	57	A10	A14	46.861
20	A4	A12	16.961	58	A19	A21	47.796
21	A33	A47	17.020	59	A22	A57	48.947
22	A34	A51	17.910	60	A3	A64	49.954
23	A12	A35	18.054	61	A19	A59	50.858
24	A33	A48	18.960	62	A9	A53	51.899
25	A26	A46	19.104	63	A9	A44	52.991
26	A33	A55	19.972	64	A18	A44	53.899
27	A2	A61	20.007	65	A18	A42	54.722
28	A62	A68	20.960	66	A10	A42	55.936
29	A2	A68	21.022	67	A9	A42	56.967
30	A41	A74	21.964	68	A7	A51	57.260
31	A2	A46	22.968	69	A9	A34	59.706
32	A11	A12	23.988	70	A3	A59	60.402
33	A27	A75	24.941	71	A30	A42	62.688
34	A12	A44	25.964	72	A19	A38	63.555
35	A1	A53	26.077	73	A19	A73	65.613
36	A5	A7	27.995	74	A7	A57	66.985
37	A8	A65	28.934	75	A7	A44	69.769
38	A1	A19	29.979				

Based on Table IV, the smaller the value of similarity between one variable and another, the genetic relationship between the two variables gets closer or higher than the similarity level and conversely, the greater the value of the dissimilarity between one variable and another, the farther is the level of similarity. It is seen that the lowest dissimilarity value or closest relationship is found between A4 and A26, which is 3.120 with similarity in fruit flesh color character that is a creamy white and sweet taste. A7 and A26 are from different areas; A7 comes from Hutanabolon village, Tukka sub-district, A26 comes from Simaninggir village, Sitahuis sub-district. This is consistent with the literature [16], which states that differences and similarities in the appearance of morphology outside the species of a plant can be used to determine close relations of genetic relationship.

C. Cluster Membership

Based on morphological characters of durian in the three sub-districts of Central Tapanuli Regency, North Sumatra results obtained from the 75 accessions of durian. It can be grouped into three groups that are members of each group, as displayed in Table V. The genetic relationship analysis is

performed using a hierarchical cluster analysis technique, which groups objects based on the similarity of characteristics found between them. Objects are classified into one or more clusters (groups) so that those in one cluster will have similarities with each other [18], [19]. The cluster analysis technique was applied to the data of observations of 15 qualitative characters from 75 accessions of the durian studied, to obtain a genetic relationship to the 75 accessions.

TABLE V
CLUSTER MEMBERSHIP OF SEVERAL ACCESSIONS IN CENTRAL TAPANULI

Accession	Three Clusters	Accession	Three Clusters
A1	3	A39	3
A2	3	A40	3
A3	3	A41	3
A4	3	A44	3
A5	1	A45	1
A6	3	A46	3
A7	1	A47	3
A8	1	A48	3
A9	1	A49	3
A10	1	A50	3
A11	3	A51	3
A12	1	A52	3
A13	3	A53	3
A14	3	A54	3
A15	3	A55	3
A16	3	A56	3
A17	3	A57	3
A18	1	A58	3
A19	1	A59	2
A20	1	A60	3
A21	3	A61	3
A22	1	A62	3
A23	3	A63	3
A24	3	A64	3
A25	1	A65	3
A26	3	A66	3
A27	3	A67	3
A28	3	A68	1
A29	3	A69	3
A30	2	A70	3
A31	3	A71	3
A32	3	A72	3
A33	3	A73	3
A34	3	A74	3
A35	1	A75	3
A36	3		
A37	3		
A38	2		

Cluster interpretation in the form of a dendrogram is shown in Fig. 3. Based on the dendrogram formed, there were three groups, group I, group II, and group III. Genetic relationships were measured on the Euclidean distance scale as 23, 24 and 25. The smaller the Euclidean distance between the objects analyzed, the closer are the object's genetic relationships and the more similarity the characters have [18], [19]. Analysis of genetic relationships based on qualitative characteristics on a distance scale of 24 shows three plant genetic relationships.

Cluster one comprised 16 members of durian accession: A3, A5, A7, A8, A9, A10, A12, A18, A19, A20, A22, A35, A43, A45 and A 68. Among the three sub-districts, the first group was united by special characters where the length of the fruit stalk was medium, its color was brown, the weight of the fruit was very light, the color of the fruit flesh was creamy white, and seed color was brownish-yellow.

Cluster two comprised three members of the accession of durian: A30, A38 and A59, where the most similar character was that length of the fruit stalk were short, the weight of the fruit was light, its color was brown, and seed color was brownish-yellow. Accessions A30 and A38 were derived from Sitahuis sub-district and A59 from Kolang sub-district.

Cluster three comprised 56 members of accession: A1, A2, A4, A6, A11,A13, A14, A15, A16, A17, A21, A23, A24, A26, A27, A28, A29, A31, A32, A34, A36, A37,A39, A40, A41, A42, A44, A46, A47,A48, A49,A50, A51,A52, A53, A54, A55, A56, A57, A58, A60, A61, A62, A63,A64, A65, A66, A67, A69, A70, A71, A72, A73, A74 and A75.

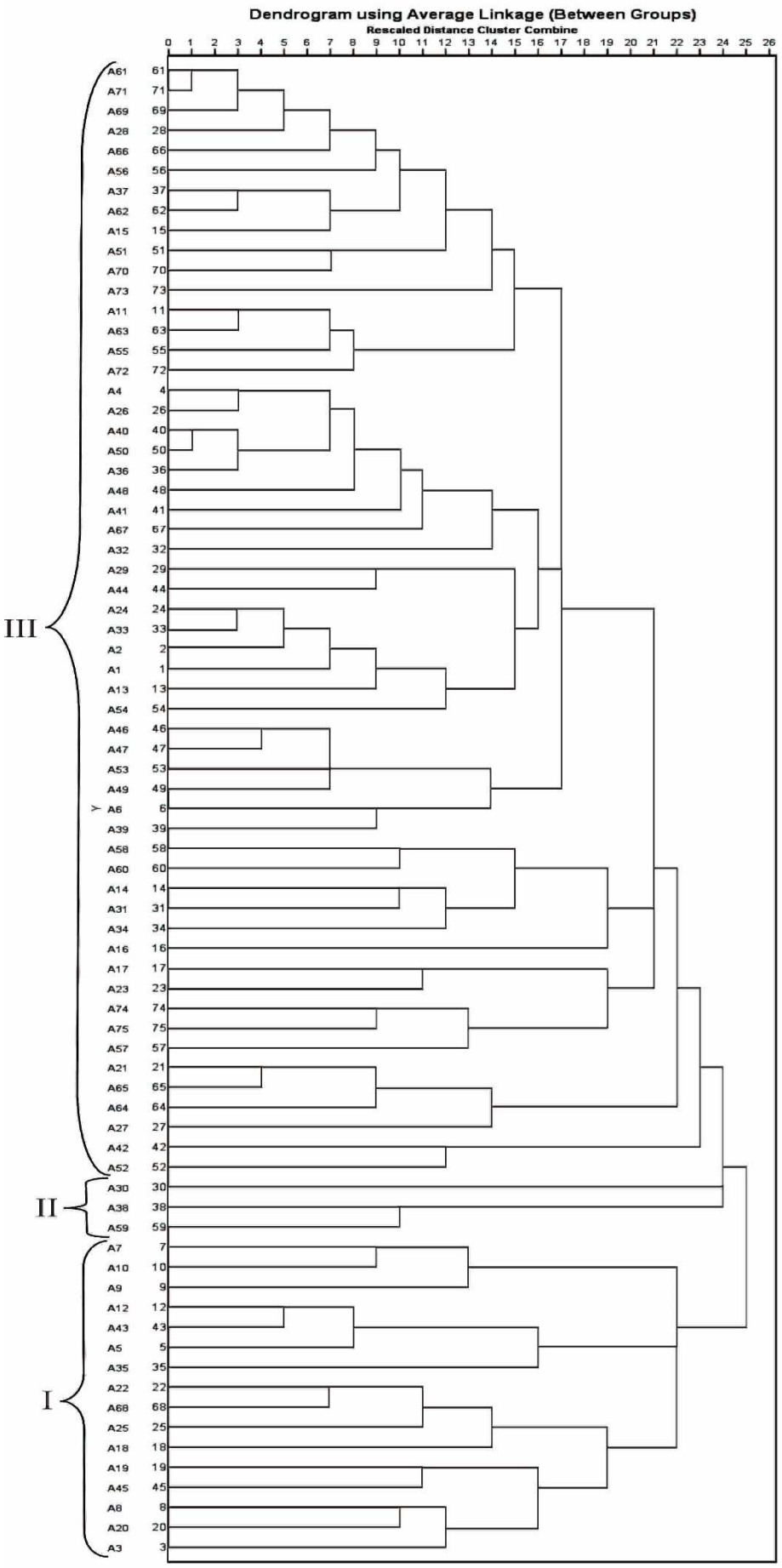

Fig. 3 Dendrogram of durian relationship in three sub-districts of Central Tapanuli District, North Sumatra, Indonesia

The accessions have a genetic relationship with eight-character from 15 characters observed: fruit shape, fruit tip shape, fruit base shape, thorn shape, fruit length, fruit skin colour and fruit flesh. This case between accessions has various characters—interactions between genetic factors and environment influence the similarity between durian accessions.

This finding is consistent with [20], which states that diversity of a plant's trait can be influenced by two factors, namely, genetic, and environmental factors or it can also be due to interactions between genetic factors and the environment. Both factors support the emergence of a trait. Selection will be valid if diversity in a population is mostly influenced by genetic factors, expressed as phenotype diversity. While a trait's appearance cannot be said to be due to environmental or genetic factors, it must be distinguished whether the diversity observed in a trait is mainly due to genetic or environmental factors. Each element that is part of the plant environment has the potential to cause different appearances. The appearance of these differences is related to the presence of genotype and environmental interactions.

These factors include temperature, soil type, soil fertility, humidity, and various cultivation practices. As an unpredictable form of the environment, factors such as rainfall, temperature, and sunlight are characteristics of location and season. Therefore, environmental terminology in the context of genotype x environment interactions is often associated with location and season factors [21]. This study indicates that several types of durian diversity possess superior traits or characters that can be used as a germplasm collection for genetic resources' conservation and active durian breeding due to the vast diversity. Durian breeding can be done by crossing and selection.

Durian characters considered superior are most likely to be used as elders in the cross-breeding of durian. However, as durian cross-breeding takes a long time, it is less effective. Therefore, the results of this study can be used for durian conservation aimed at collections as genetic resources for the benefit of durian breeding in expanding its diversity. [22] stated that broad genetic diversity would determine the success of the selection process because technically, the value of genetic diversity is to assess the value of genetic progress. From the following statement of this study's results, there are broad variations in durian based on fruit and seed characters.

IV. Conclusion

Morphological characters of the fruit's rind color are of seven types (green, yellowish-green, brownish-green, brownish-yellow, greenish-yellow, orange-yellow and pink) the fruit's flesh color has three types (creamy white, yellow, and yellow lemon) and flesh taste has five types (sweet, little sweet, sweet with a bitter taste, bittersweet and tasteless).

Morphological characters of the seed form are of five types (oval, ellipse, obovoid, ovate and rounded); seed colours are only of two kinds (brown and tawny). Based on the dendrogram formed three groups: group I, group II, and group III. Durian fruit origin found and identified in three sub-districts of Central Tapanuli district, North Sumatra, Indonesia shows that 75 accessions of durian fruit found in each location have a relatively close similarity distance.

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