Elektriese: Jurnal Sains dan Teknologi Elektro
Volume 14, Number 02, Oktober 2024
e-ISSN: 2830-3512X
https://doi.org/10.47709/elektriese.v14i02.5155

Analysis of the Relationship of Local Rice Cultivar (Oryza Sativa L.) in Bulungan District Based on Characteristics and Morphology

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Histori Naskah:
Submit: 2024-12-22
Accepted: 2024-12-25
Published: 2024-12-27

Abstrak:
Local rice originates from the Bulungan region of North Kalimantan. Generally, this rice plant is cultivated by the community and divided into two parts, namely mountain or field rice and paddy fields. Differences and similarities in morphological characters in rice cultivars can be distinguished through characterization. Morphological characterization needs to be done to identify specific characters that appear directly, especially characters related to the growth and development of rice plants that can increase the potential for rice yields. Morphological characterization analysis is used to determine the distance and kinship between rice cultivars. This study aims to determine the differences in morphological characters and kinship relationships between 6 local rice cultivars in several areas of Bulungan Regency, namely three types of rice originating from peso villages such as leto Yukon, amai sampan, and anak Leto, while three varieties are types of rice originating from Tanjung Selor. The research was conducted at the Green House of the Faculty of Agriculture, University of Kaltara. The research method used is a descriptive qualitative method, and the data was analyzed using SPSS pc 23.0 software with a scoring form that forms a cluster and produces a dendrogram. The results showed that several local rice cultivars have similarities in several morphological characteristics, such as plant age (HSS), plant height (cm), stem color, leaf blade color, leaf ear color, and leaf tongue color. The similarity coefficient formed is 1,000, and 2 groups (clusters) are formed with close kinship relationships.

Keywords: Morphological Characters, Local Rice Cultivars, Kinship Relationships, Clusters

Introduction

Rice is a cereal plant, rice after being milled into rice, which is very important for the needs of the Indonesian people in general. Rice is a staple food consumed by most of its population, with an average consumption reaching 139 kg per capita per year (FAO, 2009). The need for rice is increasing with the increasing population, while rice production is decreasing every year, this is due to land conversion and changes in local rice types into superior rice which has an impact on the planting age will be faster harvest period compared to local rice.

North Kalimantan has quite high natural resource potential, one of which is local rice, based on the characteristics of the grain, it has diversity based on color, size and tail, with the discovery of the diversity of types of rice in several sub-districts in Bulungan Regency, there are around 69 types of rice, there are 17 cultivars for glutinous rice and 52 for ordinary rice cultivars based on morphological characters (Hariyati and Utomo, 2019). Bulungan Regency is one of the regencies in North Kalimantan that has a fairly high potential for local rice germplasm. The diversity of local rice can be caused by a very close planting pattern system so that it is possible for cross-breeding between rice plants. The existence of local rice is still very dependent on local communities who carry out hereditary cultivation using both shifting cultivation systems and using rice fields, so that its availability is also determined by the type of rice planted (Hariyati and Utomo, 2019), in addition, the naming of rice is based on the name

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of the rice brought by the person who originally discovered it or based on the name of the regional language tribe to make it easier for the owner to remember it.(Hariyati, et al., 2021).

Local rice in Bulungan Regency is divided into two, namely paddy fields and dryland rice or called gogo rice. The majority of local people prefer planting using dryland rice, where the process is only to open the land, by burning, then digging without doing intensive maintenance. This method has been done since their ancestors, and they do the planting by moving every year, besides the seeds used by barter system or using seeds from the previous harvest, while the naming of the type of rice is based on the regional language tribe or from the person who brought the rice seeds.

Study Literature

The rice cultivar used comes from Peso village, Peso is one of the villages in Tanung Palas Barat District, Bulungan Regency, North Kalimantan. Where the existence of the rice by the local community is rice that has been cultivated, this is because it has a distinctive aroma, tastes good and has many panicles. In addition, the naming of the type of cultivar by the community there is based on the Dayak Kalimantan language, the name of the rice cultivar is anak leto, amai ampan and leto mukon. Based on the different naming of the rice, it is possible that the rice has similarities or kinship relationships so that it is necessary to conduct phenotypic testing through plant morphology.

This rice diversity will be more effective if clustering is carried out to see the level of similarity of rice between rice cultivars so that the level of similarity can be known, thus it is necessary to carry out morphological tests as one way to overcome to compare existing characters. Local rice diversity based on morphology has been widely carried out to see how close the level of similarity of the plant is to other plants. Many approaches are used in the classification system, but all of them start with morphological characters, such as leaf color, grain shape, grain size and others can determine the type of utilization of the characterized plant. Germplasm collections can be utilized better if the characteristics of the plant are known (Hariyati and Lestari, 2021; Hariyati et al, 2024).

Phylogenetic-based diversity studies have been widely conducted in several studies, this is considered quite effective to see the closeness which is done with the aim of seeing the level of closeness or kinship as one of the efforts in preserving rice plant germplasm, the kinship of each species can occur due to climate and geographic changes, one of which has an impact on the morphological characteristics that produce the gene expression of each plant and its interaction with the growing ecosystem (Morrone, 2006).

Research Methods

The research was conducted for 4 months from October 2023 to January 2024 at the University of Kaltara Tanjung Selor. This research requires tools and materials to support the implementation in the field and during data processing. The tools needed are scissors, plastic, gloves, stationery, label paper, color charts, cellphones, laptops, rulers, meters, manual scales, watering cans, polybags and hoes. The materials needed are 6 local rice cultivars, namely black rice and rubber rice from Antutan village, white sticky rice from Pejalin village, leto mukon, anak leto, and amai ampan from Peso village. This study was conducted using a qualitative descriptive analysis method that includes 3 stages, namely planting, observation or identification of characters in the vegetative phase, then analysis of observation data using the SPSS pc 23.0 program. The parameters to be observed in this local rice cultivar are 6 morphological characters of plant age (HST), plant height (cm), stem color, leaf blade color, leaf ear color, and leaf tongue color.

Data analysis

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Data analysis in this study used qualitative descriptive analysis techniques. Data obtained from the results of planting and observing 6 rice cultivars tested in the field will be used to analyze similarities based on the character traits to be observed. The cluster analysis method used is complete linkage (complete linkage) (Awaliah, 2018).

Table 1. Morphological Character Scoring

Character	Classification	Score
Plant Age (HSS)	Ultra Genjah (<90 HSS)	1
	Very Early (90-104 HSS)	2
	Early maturing (105-124	3
	HSS)	4
	Medium (125-150 HSS)	5
	In (>151 HSS)	
Plant Height (cm)	Short (<110 cm)	1
	Medium (110-130 cm)	2
	Height (>130 cm)	3
Bar Color	Green	1
	Green Yellow	2
	Yellow	3
	Yellow Gold	4
Leaf Color	Light green	1
	Green	2
	Dark green	3
	Purple at the End	4
	Purple on the Edges	5
	Purple and Green Mix	6
	Purple	7
Leaf Ear Color	White/Colorless	1
	Purple Striped	2
	Purple	3
Leaf Tongue Color	White/Clear	1
	Purple Striped	2
	Purple	3

Results

Morphological and Agronomic Characteristics of Local Rice

Based on observations that have been carried out during the growth period of local rice cultivars (Oryza sativa L.), growth results were obtained which were measured from several parameters, namely plant age (DAP), plant height (cm), stem color, leaf blade color, leaf ear color, and leaf tongue color.

Table 1. Plant Age (DAP)

No.	Cultivar	Plant Age (HST)	Category
1	Black Rice	152	In
2	White Sticky Rice	152	In
3	Rubber Rice	152	In
4	Leto Mukon	181	In

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5	Leto's Son	181	In
6	Amai Ampan	181	In

Table 2. Plant Height (cm)

No.	Cultivar	Plant Height (cm)	Category
1	Black Rice White	95	Short
2	Sticky Rice	107	Short
3	Rubber Rice	97	Short
4	Leto Mukon	102	Short
5	Leto's Son	113	Currently
6	Amai Ampan	118	Currently

Table 3. Bar Color

No.	Cultivar	Bar Color
1	Black Rice White Sticky	Yellow Gold
2	Rice	Green Yellow
3	Rubber Rice	Green Yellow
4	Leto Mukon	Green
5	Leto's Son	Yellow
6	Amai Ampan	Green Yellow

Table 4. Leaf Color

No.	Cultivar	Leaf Color
1	Black Rice White Sticky	Light green
2	Rice	Green
3	Rubber Rice	Dark green
4	Leto Mukon	Light green
5	Leto's Son	Dark green
6	Amai Ampan	Green

Table 5. Leaf Ear Color

No.	Cultivar	Leaf Ear Color
1	Black Rice White Sticky	White
2	Rice	White
3	Rubber Rice	White

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4	Leto Mukon	White
5	Leto's Son	White
	Amai	
6	Ampan	White

Figure 1. Leaf Ear

Table 6. Leaf Tongue Color

No.	Cultivar	Leaf Tongue Color
1	Black Rice	White
	White Sticky	
2	Rice	White
3	Rubber Rice	White
4	Leto Mukon	Purple Striped
5	Leto's Son	White
	Amai	
6	Ampan	Purple Striped

Figure 2. Leaf Tongue

Table 7. Division of Local Rice Clusters in the Dendogram

Cluster	Sub	Cultivar
I	A	1: White Sticky Rice
		2: Rubber Rice
	B	1: Amai Ampan
		2: Leto's Son
		3: Leto Mukon
II		Black Rice

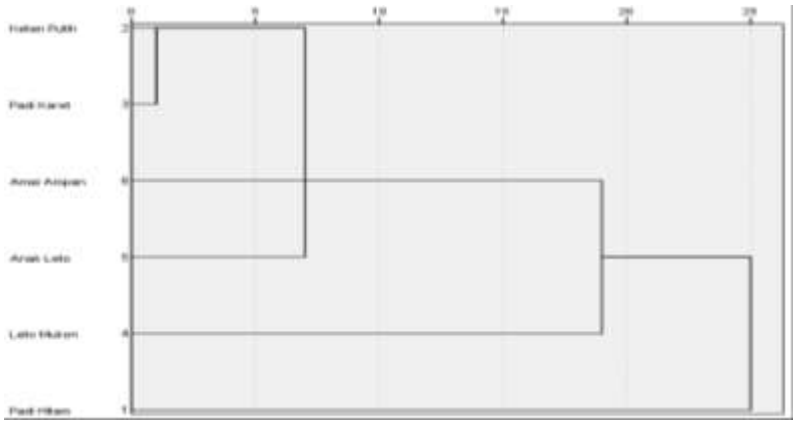

Figure 1. Dendogram based on Plant Morphological Characters

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Results

Based on observations on the age of plants from 6 cultivars such as Black Rice, White Glutinous Rice, Rubber, Leto Mukon, Anak Leto, and Amai Ampan, there was no diversity found, because of the 6 cultivars all are included in the category of deep age (score 5) with a planting period of around 5-6 months. In accordance with the opinion of Sitinjak et al., (2015) that the age of the plant can be determined by the good vegetative and generative growth phases so that rice plants whose panicles come out faster will have a relatively shorter harvest period. The age of the rice plant is calculated from the time the seedlings are transplanted until the emergence of the 6th leaf which is the last leaf in the generative growth phase of 3 cultivars of Black Rice, White Glutinous Rice, and Rubber Rice at the age of 152 days because the plants that begin to dry out due to temperatures reaching 34 ° C which causes the plants to die so that the calculation of the age of the plants is also stopped.

Based on plant height, it shows that Black Rice, White Glutinous Rice, Rubber, and Leto Mukon have plant heights in the short category (<110 cm), while Anak Leto and Amai Ampan have plant heights in the medium category (110 - 130 cm). The height of the plant stem can be influenced by the nature or characteristics of the plant. Based on plant height characteristics, rice cultivars that have short plant heights can be caused by several factors such as climate, weather conditions at the time of the study, ranging from 31 ° C - 34 ° C in April to October (BMKG Tanjung Selor, 2023), while the temperature inside the greenhouse is higher than the temperature outside so that high or extreme temperatures cause the respiration process in plants to be faster and can even affect plant growth, where plants have an impact on inhibiting the growth phase in changes in height. According to Atman, et al (2012) that a plant variety that has a shorter plant stem will absorb more sunlight compared to a variety that has a tall stem.

The color of the rice plant stem shows some diversity, from 6 rice cultivars, 1 cultivar has a green stem color, namely Leto Mukon, 3 cultivars have green and yellow stems, namely Ketan Putih, Padi Karet and Amai Ampan, 1 cultivar has a yellow stem color, namely Anak Leto, and 1 cultivar has a golden yellow color in the cultivar Padi Hitam. The leaf blades obtained some diversity, from 6 rice cultivars there are 2 cultivars that have light green leaf blade colors, namely Padi Hitam and Leto Mukon, 2 cultivars have green leaf blade colors, namely Ketan Putih and Amai Ampan, and 2 cultivars have dark green colors, namely Padi Karet and Anak Leto. The morphological character of the leaf tongue obtained from the results of observations of 6 rice cultivars, there are 4 cultivars that have white leaf ear colors (score 1) and 2 cultivars have purple striped leaf ear colors (score 2), this means that there are only two groups. Differences in overall rice plant characteristics can be caused by genetic factors of a cultivar. The genetic nature of each variety is more dominant in influencing plant growth compared to environmental influences (Sitohan et al., 2014). The results of grouping based on the same character are the basis for classifying varieties (Irawan and Purbayanti, 2008).

Local Rice Cluster Analysis

Based on the agglomerative data of cluster analysis, the similarity between cultivars is made in the form of a dendogram which can be seen in Figure 6. The results of the combined cluster analysis of 6 local rice cultivars based on morphological and agronomic characters show that no cultivar has a 100% similarity level. The closest similarity level is around 90%, which is found in the White Glutinous Rice and Rubber Rice cultivars. Thus, the local rice cultivars analyzed show specifics for each observed trait. Genotypes in one group show close kinship, while genotypes in different groups show distant kinship. The closeness of the kinship relationship is based on the similarity of morphological and agronomic characters possessed by the 6 cultivars through the dendogram (Figure 1).

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The results of the dendogram of the morphological analysis of 6 local rice cultivars produced 2 groups of rice genotypes with a similarity coefficient analysis value of 1,000. Based on the results of the analysis, the coefficient point shows the number 1,000 so that it can be concluded that several local rice cultivars observed have a close kinship relationship. The kinship relationship in the farthest cultivar has a coefficient value of 7,200 in the Black Rice cultivar. This shows that the cultivar has a distant kinship relationship with other cultivars because there are differences in the characteristics of its morphological characters. In group (cluster) I is divided into 2 subgroups, namely subgroups A and B. Group (cluster) IA consists of two cultivars, namely 2: White Glutinous Rice and 3: Rubber Rice. The group was formed because of similarities in the characteristics of plant age (HST), plant height (cm), stem color, leaf ear color and leaf tongue color. In the IB cluster, there are 3 cultivars, namely 6: Amai Ampan, 5: Anak Leto, and 4: Leto Mukon. The group was formed due to similarities in the characteristics of plant age (HSS) and leaf ear color. The characters that distinguish the IA and IB clusters are plant height (HST), stem color, leaf blade color and leaf ear color.

In group (cluster) II, there is only one cultivar, namely 1: Black Rice. This rice cultivar has 1 specific character that is very different compared to the other five cultivars, namely the golden yellow stem color character. Rice genotypes that have genetic closeness are thought to come from parents who have close kinship relationships. Meanwhile, rice genotypes with high or distant genetic distances are thought to come from parents who are distantly related (Elfianis, et al., 2021), this shows that genotypes are formed based on the closest kinship, but there are genotypes that have different names, but the level of kinship is very high. The smaller the coefficient value produced in each cluster, the greater the likelihood that rice has a kinship relationship. Likewise, the greater the coefficient value produced, the further the kinship relationship. In this case, it is possible that genetic material comes from the same parents spread across different areas. Each region has a different language, so there is a possibility that the use of the cultivar name uses the local language of origin to make it easier for farmers. In the same cluster, it is characterized by almost the same genotype name (Maulana et al., 2014).

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