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Identification and Characterization of Toraja Local Rice Germplasm

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Abstract. This study aims to identify local Toraja rice cultivars based on similarities and differences in morphological characters so that they can play a role in breeding and the conservation of local rice biodiversity. Activities carried out through exploration for seeds of local rice varieties with the main location of Sesean District, Rinding Allo District, Tikala District, Buntu Pepasan District, Kapala Pitu District, and Suloara District. Data collected in the form of the name of the local variety, origin, main character and potential yield and seeds. The results showed that local rice that was still planted in North Toraja consisted of 21 cultivars, namely *Pare Sisaling*, *Pare Kanuku*, *Seko Bulan*, *Pare Barri*, *Pare Lea*, *Pare Barri Ba'tan*, *Pare Mandoti*, *Pare Bugi'*, *Pare Kombong*, *Pare Baruku*, *Pare Lambau*, *Pare Lallodo*, *Pare Ambo'*, *Pare Kaluku*, *Pare Datte'*, *Pare Ikko' Lia*, *Pare Lottong*, *Pare Kasalle*, *Pare Bulaan*, *Pare Bau'*, *Pare Dambu*. Morphological characters that differentiate each local rice cultivar, namely : (1) Stems, consist of the number of total and productive tillers, height, diameter, type of surface, surface color, number of nodes and length of internodus; (2) Leaves, consisting of the length and color of the leaf tongue; leaf length; and size, top surface, and leaf color; (3) Flower, consisting of panicle length, number of grains in 1 panicle, shape, size, surface type, surface color, surface tip, tail at the tip of the surface (existence, length, and color), length of stalk, and color of stalk; (4) Fruit grain, consisting of shape, size, type of surface, surface color, state of the tip of the surface, tail at the tip of the surface (existence, length, and color), length of stalk, stalk color, as well as grain loss; and (5) Seeds, consisting of shape, size, color, and the presence of glutinous substances on the surface.

1. Introduction

The development of improved rice varieties depends upon access to the genetic resources of rice. These are represented by the thousands of locally adapted varieties that farmers have grown for generations and over 20 wild rice species native to Asia, Africa, and Latin America. Rice genetic resources are threatened with extinction in farming systems when farmers adopt improved varieties, and the wild species may be lost through the destruction of their habitats [1]. Approximately 90% of the world's rice is grown in the Asian continent and constitutes a staple food for 2.7 billion people worldwide [2,3].

Indonesia has large rice biodiversity. Indonesia deserves to be suspected as a secondary center of origin for rice species. This is also empirically proven by the discovery of many wild species in Indonesia. The germplasm elements that are generally used for plant genetics are the primitive forms

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of cultivated plants of the same genus, wild strains of the native habitats of cultivated plants, local varieties, old unused varieties and also strains of breeding plants that do not have commercial value, but it still has useful oxygen for breeding.

Programs, and genetic stock. Each rice variety has the same characteristics but also has distinctive character differences. The similarities and differences are often used to determine the genetic relationship between rice varieties - the more differences in nature, the further the relationship between plants. Basic grouping to classify plant varieties. Based on differences in morphological characteristics of rice plants and the area of agroecosystem adaptation, rice plants can be divided into three subspecies, namely subspecies Indica, Japonica, and Japonica or Javanica.

Toraja local rice is known to the people of South Sulawesi and neighboring regions such as the Province of West Sulawesi and even to the capital city, Jakarta. The rice/rice producing center in North Toraja in 2008 reached a harvest area of 64,602 ha with an average productivity level of 4.01 tons/ha. The area of planting of local varieties in 2008 reached 14,525 ha.

Rice favored with high economic value is determined by varieties and cultivation techniques. Toraja people usually like the taste of glutinous rice with popular varieties such as pare rice (rice) kombong, pare bau', pulu' Mandoti, pare Barri and others. This variety develops in certain specific locations where superior varieties to date have not developed much in the agroecosystem. In addition, the potential results are quite good and favored by many farmers and the community. While improved varieties are dominated by new superior varieties (VUB) for upland rice fields, these superior varieties have limited adaptability and ability to produce in specific to medium to high elevation agroecosystems. Besides this variety is very sensitive to major disease pests such as plant hopper, blast, and tungro. The new superior varieties Fatmawati and Sintanur which were released in 2003 were only able to produce well up to an altitude of 850 m above sea level. Rice fields in North Toraja Regency are located in areas with tiered slope topography ranging from moderate terrain elevation (700 m above sea level) to an altitude of 2,000 m above sea level [4].

Local varieties of rice have adaptation/suitability in certain regions, low production, high trunk and strong, deep/long age, no response to input/fertilization and still diverse appearance, have a good taste of rice and are liked by many consumers and have high market prices. There are dozens of local Toraja varieties including Pare Kombong, Pulu 'Mandoti, Pare Bau', Ikko 'Lia, Seko Bulan, Pare Barri, Pare Lea, Pare Lalodo and so on. All of these local varieties need to be maintained and preserved as regional germplasm assets and assets. It can also be used as a source of genetic diversity and as parent material for parent crossing in a variety improvement program for the future.

The characteristics of traditional (local) rice varieties have not been well identified so that their potential and development opportunities as superior local rice varieties are unknown. The appearance of local varieties in the field still looks diverse, especially the character of plant height, cooking age, grain shape, and color. This will affect the production produced by farmers in addition to the seeds of local varieties used by low-quality farmers because they are obtained from farmers' rice yields continuously and inherited from generation to generation. Therefore it is necessary to identify local Toraja varieties with the aim of knowing the main characteristics, adaptability and potential results. So that the productivity of local rice can be increased and at the same time can provide the legality of seed business to ensure the continuity of the sustainability of local rice cultivation business while maintaining the quality and quality of Toraja rice.

The purpose of this study is to find out the grouping of Toraja local rice cultivars based on similarities and differences in morphological characters so that they can play a role in efforts to conserve or breed rice plants.

2. Material and Method

This The research was carried out at the area of rice production centers in North Toraja Regency, a search and extraction of information and communication was conducted both formally and informally about the existence of local rice varieties and the spread of their crops in the field. The collaboration

was formally carried out with the North Toraja District Agriculture Office, and in the field collaborations with the District BPP officials and farmers in the local rice varieties planting centers were carried out.

The method used in this study is a qualitative descriptive method, with implementation stages which include exploration, collection, grouping/cluster, and kinship analysis. Exploration was carried out by collecting samples of local rice cultivars found in 21 districts in North Toraja Regency. Morphological characteristics were observed for each cultivar (characteristics of the stem, leaves, flowers, grain, and rice) and their anatomical characteristics. After morphological and anatomical observations, clustering and analysis of clusters for each cultivar were prepared. The kinship relationship is identified through the coding of features and then processed using the SPSS 21 for Window.

The study began with the search and collection (exploration) of seeds of local rice varieties, in November 2010 and lasted until February 2011. The main location of this research activity included Sa'dan District, Balusu District, Bangkele Kila' District, Nanggala District, Tondon District, Sesean District, Rinding Allo District, Tikala District, Buntu Pepasan District, Kapala Pitu District, and Suloara District'. Data collected in the form of the name of the local variety, origin, main character and potential yield and seeds. Kinship analysis was carried out based on quantitative characters and qualitative characters.

3. Results and discussion

Based on Table 1, local rice cultivars found in North Toraja District are quite diverse. Based on the results of the study there were 21 local rice cultivars that were still planted, namely: *Pare Sisaling*, *Pare Kanuku*, *Seko Bulan*, *Pare Barri*, *Pare Lea*, *Pare Barri Ba'tan*, *Pare Mandoti*, *Pare Bugi'*, *Pare Kombong*, *Pare Baruku*, *Pare Lambau*, *Pare Lallodo*, *Pare Ambo'*, *Pare Kaluku*, *Pare Datte'*, *Pare Ikko' Lia*, *Pare Lottong*, *Pare Lottong*, *Pare Kasalle*, *Pare Bulaan*, *Pare Bau'*, *Pare Dambu*. The 21 cultivars mentioned above are scattered in 21 districts in North Toraja (Figure 1).

It seems that the number of local rice germplasm in North Toraja has decreased over time. The reduced number of local rice cultivars found in North Toraja, especially after the introduction of superior rice seeds which tended to have a relatively fast planting age and pest resistance, so that some people considered superior rice cultivation to be more profitable.

Based on the results of the study, the grouping of local rice cultivars was based primarily on the morphological character. Twenty-one rice cultivars obtained were divided into 2 groups of cultivars, namely Indica and Japonica rice. Also, rice is also distinguished based on the condition of the rice, namely ordinary rice and sticky rice. Research results that local rice found in Tana Toraja Regency consists of 39 accessions. Some accessions with different names but taken at the same location have very close kinship levels. According to [5], that the 20 local rice cultivars from some regions in East Kalimantan had variability in morphological characters.



Figure 1. Map of the distribution of North Toraja local rice accessions.

Meanwhile, North Toraja people generally classify rice based on grain loss (*Pare Tambak and Pare kutu'*), the color of rice (*pare lottong, pare mararang and pare mabusa*), and based on the age of planting.

Table 1. Classification of Local Rice Cultivars in North Toraja

No.	Cultivars	Classification			
		Sub Species	Type	Grain loss	Plant age
1.	Pare Sisaling	Indica	Non Glutinous	easy	Short
2.	Pare Kanuku	Indica	Non Glutinous	Easy	Short
3.	Seko Bulan	Japonica	Non Glutinous	hard	Short
4.	Pare Barri	Indica	Non Glutinous	Hard	Long
5.	Pare Lea	Japonica	Non Glutinous	Easy	Long
6.	Pare Barri Ba'tan	Japonica	Non Glutinous	Easy	Long
7.	Pare Mandoti	Japonica	Glutinous	Hard	Long
8.	Pare Bugi'	Indica	Non Glutinous	Hard	Short
9.	Pare Kombong	Japonica	Glutinous	Hard	Long
10.	Pare Baruku	Japonica	Non Glutinous	Hard	Short
11.	Pare Lambau	Japonica	Non Glutinous	Easy	Long
12.	Pare Lallodo	Japonica	Glutinous	Easy	Long
13.	Pare Ambo'	Japonica	Non Glutinous	Hard	Short
14.	Pare Kaluku	Japonica	Non Glutinous	Hard	Short
15.	Pare Datte'	Japonica	Non Glutinous	Easy	Long
16.	Pare Ikko' Lia	Japonica	Glutinous	Easy	Long
17.	Pare Lottong	Japonica	Non Glutinous	Easy	Long
18.	Pare Kasalle	Japonica	Glutinous	Easy	Long

19.	Pare Bulaan	Japonica	Glutinous	Easy	Long
20.	Pare Bau'	Japonica	Non Glutinous	Easy	Long
21.	Pare Dambu	Japonica	Glutinous	Easy	Long

Cluster analysis is based on 32 characters observed, namely number of tillers, stem surface, color of stem surface, length of leaf tongue (ligula), color of leaf tongue (ligula), top surface of strands, leaf color, flag leaf, number of seeds per panicle, size grain, grain surface, surface color of the grain, tip of the grain, tail at the end of the grain, length of tail at the tip of the grain, color of the grain, color of grain, grain size, grain surface, grain color, grain end, tail at grain tip, tail length at grain tip, tail color at grain tip, grain stalk color, grain loss, rice shape, rice size, and rice color, local rice cultivars found in North Toraja Regency showed considerable diversity.

Cluster analysis with the SPSS for Windows Program (Table 2) shows that if the 21 local varieties are grouped into 4 clusters, which includes cluster 1 is Pare Bau', Cluster 2 is Pare Kombong, Pare Sisaling, Pare Kanuku, Pare Seko Bulan, Pare Barri Ba'tan, Pare Mandoti, Pare Bugi', Pare Lambau, Pare Kaluku, Pare Datte', Pare Ikko' Lia, Pare Kasalle, and Pare Bulaan, Cluster 3 consists of Pare Ambo', Pare Lallodo, and Pare Lottong and Cluster 4 namely Pare Barri. The main character that distinguishes each cluster is the color of rice, grain color and the length and color of the tail at the tip of the pan/grain

Tabel 2. Cluster Membership 21 Kultivar Padi Lokal Toraja

Case	4 Clusters	3 Clusters	2 Clusters
Z score (P_Bau')	1	1	1
Z score (P_Kombong)	2	2	2
Z score (P_Lea)	3	3	1
Z score (P_Ambo)	3	3	1
Z score (P_Lallodo)	3	3	1
Z score (P_Sisaling)	2	2	2
Z score (P_Kanuku)	2	2	2
Z score (S_Bulan)	2	2	2
Z score (P_Barri)	4	3	1
Z score (P_Ba'tan)	2	2	2
Z score (P_Mandoti)	2	2	2
Z score (P_Bugi')	2	2	2
Z score (P_Baruku)	4	3	1
Z score (P_Lambau)	2	2	2
Z score (P_Kaluku)	2	2	2
Z score (P_Datte')	2	2	2
Z score (P_Ikko'lia)	2	2	2
Z score (P_Lottong)	3	3	1
Z score (P_Kasalle)	2	2	2
Z score (P_Bulaan)	2	2	2
Zs core (P_Dambu)	2	2	2

If 3 clusters are formed then cluster 1 consists of: *Pare Bau'*, cluster 2 consists of: *Pare Kombong, Pare Sisaling, Pare Kanuku, Pare Seko Bulan, Pare Barri Ba'tan, Pare Mandoti, Pare Bugi', Pare Lambau, Pare Kaluku, Pare Datte', Pare Ikko' Lia, Pare Kasalle, Pare Bulaan and Pare Dambu.* Cluster 3 consists of: *Pare Lea, Pare Ambo, Pare Lallodo, Pare Barri, Pare Baruku, and Pare Lottong.* The main characteristics that distinguish each cluster are the color of rice, grain color and length of tail at the tip of panicle / grain.

If 2 clusters are formed then cluster 1 consists of: *Pare Bau* ', *Lea Pare*, *Ambo Pare*'. *Pare Lallodo*, *Pare Barri*, *Pare Baruku*, and *Pare Lottong*, cluster 2 consists of: *Pare Kombong*, *Pare Sisaling*, *Pare Kanuku*, *Pare Seko Bulan*, *Pare Barri Ba'tan*, *Pare Mandoti*, *Pare Bugi* ', *Pare Lambau*. *Pare Kaluku*, *Pare Datte* ', *Pare Ikko' Lia*, *Pare Kasalle*, *Pare Bulaan*, and *Pare Dambu*. The main character that distinguishes each cluster is the color of rice and the state of the tail at the tip of the panicle. According to the research of [4], the character of rice that can distinguish local rice cultivars in Toraja is the shape, size, and color of the rice. Morphological data can be used to verify after getting molecular data [6,7]

The dendrogram using average linkage is presented in Figure 2. Figure 2 shows that the maximum similarity value between local rice accessions is 25% indicating that the genetic diversity of local rice germplasm in North Toraja is quite high at more than 75%. According to [8] that the closest genetic distance was between Pare Pulu and Pare Lottong. The same findings by Pachauri [9] using dendrogram derived from UPGMA cluster analysis.

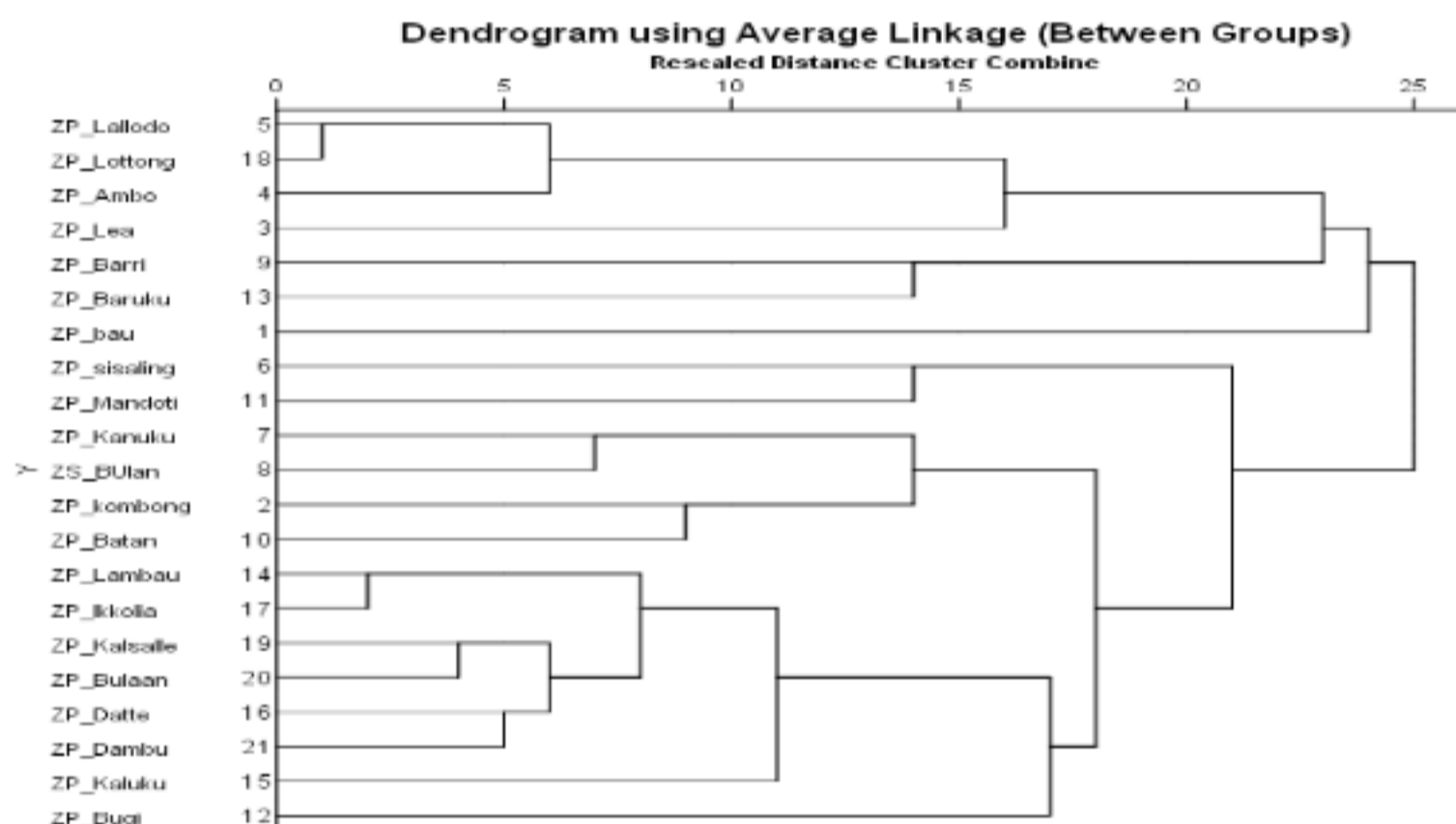


Figure 2. Dendrogram of kinship relations between 21 North Toraja local rice accessions

4. Conclusion

1. The morphological characters that distinguish each local rice cultivar are:
Stems, leaves.
2. Toraja local rice varieties are maybe considered as heavy very large genetic diversity of their local rice germplasm (75%) which is determined very closely by the color of rice grain and their own.

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