

# Inventory and morphological characterization of local upland rice in the highlands of South Sumatra province

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**Abstract.** South Sumatra has various types of local rice in various agroecosystems that have the potential as plant genetic resources (PGR) of food crops. At present, the existence of the PGR has been diminished due to genetic erosion. Inventory and characterization of local rice genetic resources were carried out in the highlands of South Sumatra during 2014–2017. The study was conducted in Muara Enim, Ogan Komering Ulu, Pagar Alam, and Lahat Regencies. The objective of the study was to inventory and characterize the PGR. The method used was exploration and desk study. Purposive sampling was applied. Morpho-agronomic characterization was carried out *in situ* and *ex situ*. Morphological observations were carried out by visually observing the parts of leaves, stems, panicles and unhulled seeds of the rice accessions in the location. Morphological characteristics were analyzed descriptively by tabulation. Inventory result showed 17 varieties of local upland rice were spread across four regencies. Local upland rice varieties originating from the regencies with different biophysical characteristics showed differences in morphological characteristics. Among the 17 local varieties, 3 varieties were characterized, namely Setangkai, Barokah and Ayek Keruh. Morpho-agronomic characterization results showed that there was a high diversity of rice accessions collected from different locations in South Sumatra.

Keywords: inventory, characterization, local rice.

## 1. Introduction

Rice is the staple food for the majority of Indonesian people. According to Indonesian Center for Agricultural Data and Information [1], the average national rice consumption reached 103.18 kg/capita/year. This amount is much higher than the consumption of other foods such as sweet potatoes which only reaches 6.64 kg/capita/year. Efforts to increase rice production must be continued through intensification and extensification to achieve food self-sufficiency. Development of modern biology, such as biotechnology, molecular biology and genetic engineering, is expected to solve the problem of food



availability [2]. However, it relies on the availability of genetic resources. Therefore, local rice varieties have an indirect role in supporting the efforts to meet the food demand.

Local rice varieties are those that have long been adapted to certain areas. This variety has location-specific characteristics for the area. South Sumatra is one of the provinces in Indonesia that has a high diversity of local rice varieties due to adaptation to the environment where they grow. This diversity supports both the effort to meet the future food demand and the development of genetic resources [3].

Efforts to inventory, identify and conserve local rice varieties are expected to help preserve the biological treasure. Further conservation efforts will eliminate fears of the destruction of local superior rice because there is a tendency for the degradation of local rice varieties, especially in South Sumatra. A survey done by the South Sumatra Assessment Institute for Agricultural Technology (AIAT) from 2003 until 2014 found a decrease in the number of local rice varieties [3]. In one of the highland dryland locations, some local rice varieties previously planted by farmers were already difficult to find. Research needs to be done to get actual data on the existence of local rice varieties. The objectives of this study were: (1) to inventory and map the spread of local rice in highlands of South Sumatra Province, (2) to characterize the morphology and agronomy of each local rice variety, and (3) to collect information on the presence of local rice variety as an initial conservation effort.

## 2. Materials and methods

The research was carried out during 2014–2017 on the highlands of Muara Enim, Ogan Komering Ulu, Pagar Alam and Lahat Regencies. The method used was exploration and desk study. The samples for characterization were selected by purposive sampling, with five plants were collected for each rice variety. Morpho-agronomic characterization was carried out *in situ* and *ex situ*. Morphological observations were performed by visually observing the parts of leaves, stems, panicles and unhulled seeds of the rice accessions in the location. Morphological characteristics were analyzed descriptively by tabulation.

## 3. Results and discussion

Diverse geography and agroecosystems in the region of South Sumatra make this province rich in biodiversity and genetic resources. The yield and quality of many local rice varieties in this area are equal to those of improved varieties introduced from outside South Sumatra. The dryland of South Sumatra is distributed on lowland and highland plains. Dry lowland area is divided into flat-wavy, wavy and hilly reliefs. According to Indonesian Center for Soil and Agroclimate Research [4], dryland areas in South Sumatra occupy about 86.4% of the total area of the province. They have great potential in supporting the development of agriculture (food and plantations).

The drylands in the highlands of South Sumatra Province are also suitable for development [5]. Potential dryland areas to be developed are distributed across six regencies, namely Ogan Komering Ulu (OKU), East OKU, South OKU, Muara Enim, Lahat and Musi Rawas [6]. According to Murtlaksono and Anwar [7], dryland areas in South Sumatra are acidic with the following soil characteristics: acidic (pH <5), low organic matter, base saturation <50% (district), high Al, precipitation >2,000 mm/year, low fertility and land productivity that need high input for cultivation. Furthermore, Murtlaksono and Anwar [7] stated that the constraints in the use of acidic dryland are water availability, high soil acidity (low pH), low organic matter and shallow topsoil, very poor in nutrients and rocky soil.

In total 17 local superior rice varieties were found in highland plains of Pagar Alam, Muara Enim and Lahat Regencies, i.e. 10 varieties in Lahat District, 5 varieties in Pagar Alam and 1 variety each in Muara Enim and Ogan Komering Ulu. Several accessions with the same name were found in several villages, although they are morphologically different. Further research is needed to resolve these duplications. The data on the distribution of local rice varieties and the grain characteristics of each variety are presented in Table 1 and Table 2, respectively.

Among the 17 local varieties, 3 varieties were characterized. These were Setangkai found in the village of Pagar Wangi, North Dempo, Pagar Alam at an altitude of 914 m above sea level (m asl); Ayek Keruh in Gunung Lewat, Sukamerindu, Lahat, located at 806 m asl, and in Talang Camai, Selibar, North Pagar Alam at 878 m asl (Figure 1); Barokah in the village of Tumbak Ulas, South Pagar Alam at the altitude of 714 m asl (Figure 2).

**Table 1.** Distribution of local rice varieties in the highlands of South Sumatra.

Exploration year	Name of variety	Regency	Number
2013	Selebur Rimbe	Muara Enim	1
	Beram, Pulut	Pagar Alam	2
2014	Tambun, Meghun, Gilas Madu, Dayang Rindu, Madu, Abang, Agai Keluang Putih, Henik, Rindik, Merah	Lahat	10
2015	Serubuh Balai	Ogan Komering Ulu	1
2016	Ayek Keruh	Pagar Alam	1
2017	Setangkai, Barokah	Pagar Alam	2
Total			17

In general, those local rice varieties have low productivity, except for Ayek Keruh. Based on a field test in Sukamerindu, Lahat, this accession yielded 8.56 t/ha, which exceeded the yield of Ciherang, an improved national variety (6.4 t/ha). The productivity of Ayek Keruh was also much higher than local rice varieties in Central Java which ranged from 2.2 to 3.8 t/ha. Previously, the highest productivity of local rice varieties was reported from Kalimantan which is 5.18 t/ha. Performance of local variety of Ayek Keruh in Pagar Alam was presented in Figure 1. Ayek Keruh is known to have a high selling value. This early maturing variety (110 days) has a high panicle number per plant (25) and grain number per panicle (>200). This variety is resistant to brown planthopper and blast pathogen. The seed shape is oval and thick (Table 2).



**Figure 1.** Performance of Ayek Keruh local rice variety at generative stage in Pagar Alam Regency, South Sumatra.

**Table 2.** Grain characteristics of local rice varieties in the highlands of South Sumatra.

Name of variety	Regency	Diameter (mm)	Length (mm)	Thickness (mm)	Shape	Lemma and palea (downy/not; hairy/not; color)	AWN (downy/not; hairy/not; color; shape)	100-grain weight (g)
Selebur Rimbe	Sri Tanjung, Muara Enim	2.6	7.9	1.6	Short round	Not downy	Not downy	2.2–2.6
Beram	Pagar Alam	2.9	8.19	1.9	Short round	Not downy	Downy	2.35–2.61
Pulut	Pagar Alam	2.9	8.19	1.9	Short round	Not downy; brownish-yellow	Downy	2.35–2.61
Tambun	Tanjung Telang & Tanah Pilih, Lahat	2.9	8.19	1.9	Short round	Not downy; brownish-yellow	Downy	2.35–2.61
Henik	Tanjung Telang & Payo, Lahat	2.3–2.63	7.5–8.6	1.77–1.85	Oval	Hairless	Downy; yellow end of the grain	1.93–2.09
Dayang Rindu	Tanjung Telang & Tanah Pilih, Lahat	2.63	9.33	2.0	Crescent	Dark	Sharp tip	2.13
Gilas Madu	Gunung Kembang, Lahat	2.97	7.2	1.93	Short round	Hairless	Hairless	2.14
Padi Agai Keluang Putih	Banjar Sari, Lahat	2.7	9.1	1.9	Long oval, curved like a sickle	Hairless	Downy	1.88
Abang	Sugih Waras, Lahat	2.5	9.4	1.8	Hairy; reddish-yellow	Downy	White	2.357
Meghun	Babat Baru, Lahat	3.0	7.47	1.87	Almost round	Hairless	Hairless	1.91
Rindik	Babat Baru, Lahat	2.9	6.47	1.87	Almost round	Hairless	Hairless	1.91
Merah	Jaya Baya, Lahat	2.7	8.5	-	Flat oval	Downy; hairless	Transparent white	2.35
Madu	Babatbaru, Lahat	2.8	7.4	1.9	Thick	Hairless	Hairy; yellow	1.7
Serubuh Balai	Tihang, OKU	2.5	6.9	1.6	Almost round	Hairless	Hairy; yellow	1.602
Ayek Keruh	Talang Camai, Pagar Alam	2.9	7.0	1.9	Oval and thick	Hairless	Hairy; yellow	1.6
Setangkai	Pagarwangi, Pagar Alam	2.5	9.4	1.8	Hairy; reddish-yellow	Hairy; yellow	White	2.357
Barokah	Tumbak Ulas, Pagar Alam	2.6	7.2	1.9	Oval and thick	Hairless; yellowish-brown	Hairy; yellow	1.8

Important characteristics of the three varieties resulting from this characterization activity include adaptability to high altitude up to 700 m asl, relatively higher yield potential compared to other local varieties and extensive adaptability in local agroecosystems. Other important characters are resistance to pests and diseases, especially brown planthopper and blast. Based on these characteristics, the three varieties are recommended to be developed as adaptive local varieties for the highlands.

Plant performance of the three varieties in the field appeared to be relatively uniform, so seed purification was not needed. This condition was achieved because farmers were accustomed in preparing seeds by themselves by selecting seeds from uniform and healthy plants. By using this method, pure lines were resulted and local farmers claimed that the seed quality they prepare were comparable to the certified seeds.



**Figure 2.** Performance of Barokah, a local rice variety, at the generative stage in Pagar Alam Regency, South Sumatra.

The massive planting of new improved varieties has a positive impact on national rice production, but has a negative effect on the on-farm conservation of the local rice varieties. Since local rice varieties have developed specific characteristics for adaptation to the local agroecosystems, they need to be protected through on-farm or *ex situ* conservations. Therefore, similar efforts to preserve and develop local varieties must be done to avoid the extinction of useful genetic resources. Inventory and characterization studies that we have initiated are preliminary steps to preserve local rice varieties in the highlands of South Sumatra.

#### 4. Conclusions

Seventeen local rice varieties were identified during the inventory in the highlands of South Sumatra. These local rice varieties were distributed in four regencies in South Sumatra. Ten accessions were found in Lahat, 5 accessions in Pagar Alam and 1 accession each in Muara Enim and Ogan Komering Ulu Districts. Local rice varieties grown in different land typologies with different soil characteristics showed different morphological characteristics. The three varieties are recommended to be developed as adaptive local rice varieties for the highlands, namely Setangkai, Barokah and Ayek Keruh.

## 5. References

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