Short Report

Investigation on the Isozyme Genotype and KClO₃ Resistance of Seedlings in African Deep Water Rice, *Oryza glaberrima* Steudel*

Hiroko HAKODA, Jun INOUE and Nyat Q. NG**

(Faculty of Agriculture, Kyushu University,
Fukuoka 812, Japan ; **International Institute of
Tropical Agriculture, Ibadan, Nigeria)

Received July 31, 1989

グラベリマ浮稲のアイソザイム遺伝子型と塩素酸カリ抵抗性について：箱田寛子，井之上準，N.Q. NG**

(九州大学農学部，**国際熱帯農業研究所)

キーワード：アイソザイム，浮稲，塩素酸カリ抵抗性，グラベリマイネ。

Key words : Deep water rice, Isozyme, KClO₃ resistance, *Oryza glaberrima*.

In West Africa, deep water rices of two different species, *Oryza sativa* L. and *O. glaberrima* Steud. are cultivated. The *glaberrima* rice is endemic to West Africa⁴⁾. These two species have evolved independently from different wild ancestors, which have elongation ability⁵⁾.

The *sativa* rice is divisible into the Indica and Japonica types. Portères¹⁰⁾ reported such differentiation comparable to Indica-Japonica type among *glaberrima* varieties, but later researchers failed to confirm it⁴⁾. In *sativa* rice varieties, some isozyme loci show marked differences in allelic frequency between Indica and Japonica types ; *Acp-1*⁴, *Est-2*^s, *Cat-1*¹, *Pgi-1*¹ and *Pgi-2*² are found among Indica type varieties, while *Acp-1*⁹, *Est-2*^{nul}, *Cat-1*², *Pgi-1*² and *Pgi-2*¹ are found among Japonica type varieties²⁾. Similarly, KClO₃ (potassium chlorate) resistance of seedlings has also been adapted as a useful technique to classify *sativa* rice varieties into the two types^{6,8)}. In this paper, genetic structure of *glaberrima* deep water rice was examined on the basis of isozyme genotype and KClO₃ resistance.

Materials and Methods

In this experiment, 32 varieties were *glaberrima* deep water rice obtained from the IITA, and 140 were *sativa* deep water rice—each 70 varieties from Bangladesh and Thailand.

The manners and procedures of electrophoresis used were almost the same those described by Pai et al⁹⁾. for acid phosphatase

(ACP), Nakagahra⁷⁾ for esterase (EST), Ishikawa et al³⁾. for catalase (CAT) and phosphoglucose isomerase (PGI).

The testing method of KClO₃ resistance of seedlings was almost the same as that used by Ueno¹²⁾. The KClO₃ resistance was evaluated by the percentage of shoot length growing in 0.1% KClO₃ solution to the shoot length of control plant growing in distilled water.

Results and Discussion

So far as five isozyme loci were concerned, all the isozyme alleles found in *O. glaberrima* deep water rice were found in *O. sativa* deep water rice (Table 1). For these loci, *glaberrima*

Table 1. Frequencies of isozyme genotypes in *glaberrima* and *sativa* deep water rice varieties (%).

Isozyme genotype	<i>glaberrima</i>	<i>sativa</i>	
		Bangladesh	Thailand
<i>Acp-1</i> ⁴	0.0	80.0	100.0
<i>Acp-1</i> ⁹	100.0	20.0	0.0
<i>Est-2</i> ^s	100.0	35.7	52.9
<i>Est-2</i> ^F	0.0	24.3	47.1
<i>Est-2</i> ^{nul}	0.0	40.0	0.0
<i>Cat-1</i> ¹	100.0	98.6	100.0
<i>Cat-1</i> ²	0.0	1.4	0.0
<i>Pgi-1</i> ¹	96.9	62.8	58.6
<i>Pgi-1</i> ²	3.1	37.2	41.4
<i>Pgi-2</i> ¹	100.0	71.4	58.6
<i>Pgi-2</i> ²	0.0	28.6	41.4
No. of var.	32	70	70

*Presented at the 187th meeting of the Crop Science Society of Japan, April, 1989.

Table 2. Frequency distribution of KClO₃ resistance of seedlings of *glaberrima* and *sativa* deep water rice varieties.

Deep Water Rice	0.1% KClO ₃ resistance (%)										Average
	0 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	
<i>O. glaberrima</i>			4	9	9	6	1	3			44.8
<i>O. sativa</i>											
Bangladesh			25	30	11	3	1				34.5
Thailand			17	38	10	3	1	1			36.0

deep water rice varieties were almost monomorphic, with the exception of *Pgi-1* (*Pgi-1*¹ = 96.9%), whereas *sativa* deep water rice varieties were polymorphic. The *glaberrima* deep water rice had both Indica type (*Est-2*^s, *Cat-1*¹ and *Pgi-1*¹) and Japonica type (*Acp-1*⁹ and *Pgi-2*¹) isozyme alleles. The existence of *Acp-1*⁹ in *glaberrima* varieties¹⁾ was reaffirmed.

Surveying 40 isozyme loci, Second¹¹⁾ found a small genetic diversity in *glaberrima* varieties. According to him, approximately equal genetic distances were found between *glaberrima* and "ancestral" types of Indica and Japonica.

Morishima et al.⁶⁾ reported in *sativa* rice that Indica and Japonica types could be well distinguished by KClO₃ resistance of seedlings with the least probability of misclassification. In the present study, KClO₃ resistance in *glaberrima* deep water rice did not differentiate into the two groups (Table 2). According to Morishima et al.⁴⁾, a discriminant formula consisting four characters including KClO₃ resistance could well distinguish into the two types; but for those of *glaberrima* varieties such a difference did not result. Besides KClO₃ resistance, *glaberrima* and *sativa* rices showed overlapping variation in ranges in various characters⁴⁾.

On the basis of isozyme genotype, *glaberrima* deep water rice was almost monomorphic, and

consisted of Indica and Japonica type alleles. On the other hand, KClO₃ resistance of *glaberrima* deep water rice was very similar to that of deep water rices from Bangladesh and Thailand.

References

1. Bezancon, G. et al. 1978. In Rice in Africa. (Ed.) I.W. Buddenhagen et al., Academic Press, New York, 45—60.
2. Endo, T. et al. 1983. In Isozymes in Plant Genetics and Breeding, Part B. Elsevier, Amsterdam. 129—146.
3. Ishikawa, R. et al. 1987. Mem. Fac. Agric. Hokkaido Univ. 15 : 371—379*.
4. Morishima, H. et al. 1962. Japan. J. Breed. 12 : 153—165.
5. ——— et al. 1963. Evolution 17 : 170—181.
6. ——— et al. 1981. Japan. J. Breed. 31 : 402—413.
7. Nakagahra, M. 1978. Trop. Agric. Res. Ser. 11 : 77—82.
8. Oka, H.I. 1958. Ind. J. Genet. Plant Breed. 18 : 79—89.
9. Pai, C. et al. 1975. Can. J. Genet. Cytol. 17 : 637—650.
10. Portères, R. 1956. J. Agric. Trop. Bot. Appl. 3 : 341—856.
11. Second, G. 1982. Jap. J. Genet. 57 : 25—57.
12. Ueno, K. 1988. Bull. Inst. Agric. Res. Tohoku Univ. 39 : 43—49*.

*In Japanese with English summary.