Inheritance of Grain Shape in Rice (*Oryza sativa* L.)

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벼 입형의 유전

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Objectives

To identify the mode of inheritance of grain shape in rice.

Materials and methods

The experimental materials used were Daeripjong(P1) with large-shape grain and Manongbare(P2) with small-shape and their progenies, F1, F2, B1(F1×P1) and B2(F1×P2), were planted with 2 replications and measured for grain shape to perform genetic analysis They were transplanted to a paddy field with a single plant per hill spaced at 30×15 cm. Data were collected from each plant on the grain shape related traits such as Grain length, Grain width, Length-width ratio, and 1000-grain weight. Genetic analysis of these traits were conducted with scaling test and components of generation means proposed by Mather (1949), Hayman and Mather (1955) and Hayman (1958).

Results

Daeripjong was one of the large grain shape germplasms, while Manongbare was one of the small grain shape germplasms. (Fig.1). In the scaling test, the values of A, B and C for four traits(Grain length, Grain width, Length-width ratio, 1000-grain weight) were not significantly different from zero. The [d] component was positive in all four traits . The [h] component was negative in all characters. The average degree of dominance ([h] / [d]) was less than unity for all traits(Table 1).

In the joint scaling test, The results of chi-square test of the deviation of the observed mean from the expected mean for each progeny were found non-significance which proves that employment of the genetic analysis for all four traits is adequate.(Table 2).

The heritabilities of grain length, grain width, length-width ratio, and 1000-grain weight were highly estimated as 0.92, 0.66, 0.90, and 0.98 respectively. The estimates of gene effects by fitting three of two parameter showed the adequacy of the additive-dominance model without epistasis for all traits of the cross. The additive effects exceeded the corresponding dominance effects for all traits which indicated the presence of either partial dominance or no dominance

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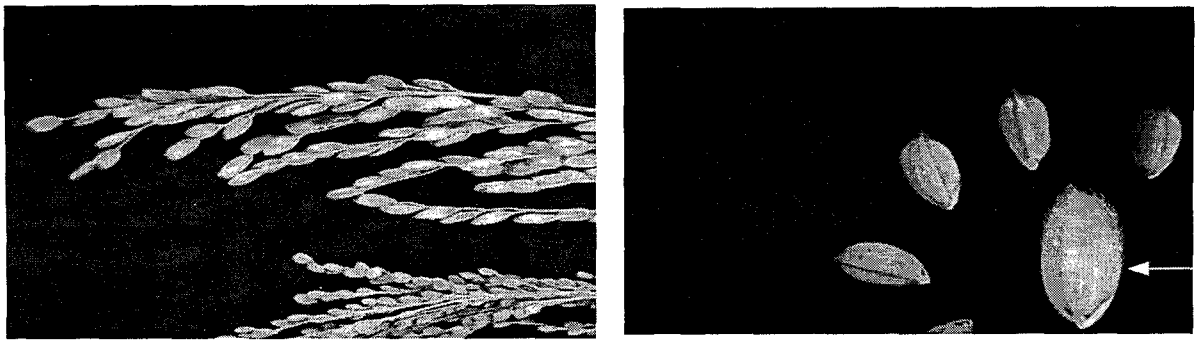

Fig. 1. Variation in shape of unhulled rice in two parents, Daeripjong(A) and Manongbare(B).

Table 1. Scaling test and estimates of gene effects of the grain shape for six populations from the cross between Daeripjong and Manongbare.

Parameter	Grain length	Grain width	Length/ Width	1000-grain weight
Scaling test				
A	0.5±2.4	0.0±0.5	0.2±0.8	-4.5±11.7
B	0.5±0.9	0.3±0.4	0.0±0.4	-5.0±13.9
C	1.5±4.6	0.1±1.1	0.6±1.7	-8.6±27.2
Estimates of gene effects				
M	7.7±0.2**	3.3±0.1**	2.3±0.1**	28.5±0.4**
[d]	2.1±0.2**	0.8±0.1**	0.2±0.1ns	15.3±0.4**
[h]	-1.4±0.4**	-0.4±0.2*	-0.1±0.2ns	-0.1±0.1ns
[h] / [d]	0.68	0.51	0.57	0.15
Heritability	0.92	0.66	0.90	0.98

†*, ** Significant at the 0.05 and 0.01 probability levels, respectively.

Table 2. Generation means and joint scaling test of the grain shape for six populations from the cross between Daeripjong and Manongbare.

Gen.	Grain length		Grain width		Length /Width		1000-grain weight	
	O†	E‡	O	E	O	E	O	E
P_1	9.8±0.4	9.8	4.1±0.2	4.1	2.4±0.1	2.4	43.8±0.8	43.7
P_2	5.6±0.2	5.6	2.5±0.1	2.5	2.3±0.1	2.3	13.2±0.3	13.2
F_1	6.2±0.4	6.3	2.9±0.1	2.9	2.1±0.2	2.1	31.0±1.4	30.8
F_2	7.3±1.1	7.0	3.1±0.3	3.1	2.4±0.4	2.2	27.6±6.7	29.6
B_1	8.2±1.2	8.0	3.5±0.2	3.5	2.4±0.4	2.3	35.1±5.8	37.3
B_2	6.2±0.4	6.0	2.8±0.2	2.7	2.2±0.2	2.2	19.6±6.9	22.0
χ^2 value	0.026ns		0.004ns		0.012ns		0.529ns	

† Observed means, ‡ Expected means

ns, *, ** non-significant, significant at 0.05 and at 0.01 probability levels, respectively.