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Short communication. A spontaneous mutant of 'L-202' rice

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Abstract

A new spontaneous phenotype of the rice cultivar 'L-202' was found. Mendelian analysis indicates that it is a monogenic, recessive mutant. Its distinguishing features are: dark blue-green colour, short and narrow leaves, high tillering and relatively short height. The objectives of this study were: to characterize it, to determine if it is heritable and if so, its genetic basis. Its distinguishing features are: dark blue-green colour, short and narrow leaves, high tillering and relatively short height. Selfing the new phenotype resulted in a uniform progeny, with the traits of the parent plant ("wild type"). Crossing the new phenotype with the normal 'L-202' cultivar resulted in a uniform F_1 hybrid generation, with the wild type. The F_2 generation showed a mendelian seggregation which did not depart significantly from three normal plants : one new phenotype. It is concluded that it is a monogenic, recessive mutant.

Additional key words: dwarf mutant, Mendelian segregation, *Oryza sativa*

Resumen

Comunicación corta. Un mutante espontáneo de la variedad de arroz 'L-202'

Se ha encontrado un nuevo fenotipo espontáneo del cultivar de arroz 'L-202'. Los objetivos de este estudio fueron: caracterizarlo, determinar si es heredable y, en tal caso, su base genética. Sus características distintivas son: color verde-azulado obscuro, hojas cortas y estrechas, abundante ahijamiento y altura relativamente corta. Al autofecundar el nuevo fenotipo, toda la progenie fue uniforme, con los mismos rasgos que la planta parental. Al cruzar el nuevo fenotipo con el cultivar 'L-202', la generación híbrida F_1 fue uniforme, de fenotipo normal. La generación F_2 mostró una segregación mendeliana que no difirió significativamente de tres plantas normales : un nuevo fenotipo. Se concluye que es un mutante monogénico recesivo.

Palabras clave adicionales: mutante enano, *Oryza sativa,* segregación mendeliana.

'L-202' is a long-grained Californian rice cultivar which carries a semi-dwarf gene from the green revolution (Tseng *et al.*, 1984). It is named Thaibonnet in Europe. In the Departamento del Arroz (Sueca, Valencia, Spain), a lineage of 'L202' has been selfed for about 20 years. In the last years, some plants with "dwarf" phenotypes started to appear in it. The mutant plant has a dark blue-green colour, short and narrow leaves, abundant tillering and relatively short height. There is no known disease causing these symptoms (Ou, 1972). Wild and mutant plants were grown under the same fertilisation and conditions, transplanted to pots and to the field. The values of the main phenotypic characters (except plant height) are shown in Table 1. In the field, both phenotypes showed larger values of plant height (Table 2), tiller number, grain weight and slightly bigger grain dimensions than in pots.

Selfed seed was collected from the new phenotype, germinated and transplanted in the field in 2004. All the 220 progeny plants presented the same phenotype, indicating that it is hereditary. Plant height of 18 of them was measured and compared with adjacent 'L-202' by the Student-t test. They were significantly shorter and the same applied to four mutant progenies grown in 2008 (Table 2).

A cross was effected between the normal phenotype of 'L-202' as mother plant (by emasculation) and the new phenotype. All the resulting 18 F_1 hybrid plants

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Table 1. Phenotypic comparison between a spontaneous mutant and wild 'L-202'

	L-202	Mutant	t_2[3]
Panicle length (cm)			
- pot	16.90	14.80	0.5ns
- field	16.95	15.10	0.4ns
Number of panicles			
- pot	17.0	39.0	-
- field	40.5	75.5	3.0ns
Grain weight (g at 14%rh)[1]			
- pot	41.0	37.0	-
- field	140.7	76.6	1.5ns
Flag leaf length (cm)			
- pot	27.0	16.0	2.7ns
- field	25.7	13.5	7.2*
Flag leaf width (mm)			
- pot	14	6	7.6*
- field	13	6	7ns
Days to 50% heading			
- pot	107	111	-
- field	100	100	ns
Days to maturity			
- pot	147	166	-
- field	141	148	7ns
Grain[2] length (mm)			
- pot	8.16	7.87	0.9ns
- field	8.13	7.91	1.8ns
Grain[2] width (mm)			
- pot	2.29	2.20	1.1ns
- field	2.48	2.34	4.6***
Grain[2] length/width			
- pot	3.6	3.6	ns
- field	3.3	3.4	-

[1] yield per plant; rh=relative humidity. [2] dehusked. [3] t-test (with 2 degrees of freedom) significance of differences between L-202 and mutant means (there was only one plant per genotype in pots). ns,*,***:non significant, significant at *P* ($\alpha \leq 0.05$) and ($\alpha \leq 0.005$), respectively. Flag leaf width and days to maturity in the field, have one degree of freedom. Grain dimensions have 48 degrees of freedom (except grain width in pots, which has 37).

showed the "wild type", and their average plant height was not significantly different from adjacent 'L-202' plants (Table 2), indicating its complete dominance. The F_2 generation obtained by selfing segregated (Fig. 1). From a total of 1,173 F_2 plants transplanted in the field, 896 showed the normal phenotype (with a mean plant height of 100.7 cm) and 277 showed the new phenotype (with a mean plant height of 77.6 cm). This segregation is not significantly different from 3:1 (χ^2_1=1.20 non significant), indicating a monogenic, recessive mutation. No disease transmitted through seed shows a Mendelian seggregation in the host. The mutant phenotype is best characterized by the combination of colour and leaf dimensions: although normal F_2 plants grown in the field were significantly taller than mutants (Table 2), there was an overlapping (maximum plant height of the mutant reached 87 cm and the minimum height of the normal phenotype was 83 cm).

The mutant tillers more profusely than the normal phenotype (Table 1). This recalls the genetic linkage which exists between the *sd*1 gene (responsible for semi-dwarfism in the green revolution) and tillering (semi-dwarfs tiller more than normal plants) (Khush, 1984). The mutation could be an allele of *sd1*, but further genetic research would be needed to confirm it. In any case, the mutant's lower yield per plant and lower plant height (Table 1) prevents its direct agronomic use.

It is concluded that this new phenotype of 'L-202' is a monogenic, recessive mutant. Some seed is available from the author.

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Table 2. Comparison of plant height means (in cm)

	2004 field	2007 field	2008 field	2008 pots
L-202	86.6		98.8	76
Mutant	62.9		69.5	56
Comparison	t_{37}=28.6***		$t_{42=}$18.7***	—
L-202		86.9		
F_1		85.5		
Comparison		$t_{24=}$1.6ns		
"wild type" F_2			100.7	
Mutant F_2			77.6	
Comparison			t_{1166}=57.4***	

ns,*,***: non significant, significant at *P* ($\alpha \leq 0.05$) and ($\alpha \leq 0.005$), respectively.

Figure 1. Wild 'L202' plants (left row), mutants (central row) and segregating F_2 (right rows).

Muñoz was in charge of the field operations. María José Gómez determined grain moisture.

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