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GENETIC STUDIES ON THE MILDEW RESISTANCE GENE IN A NEPALI BARLEY (*HORDEUM VULGARE* L.)

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Abstract

A six-rowed winter type Nepali barley genotype B5A/1 possesses one resistance gene to powdery mildew (*Erysiphe graminis hordei*) isolate AB14 which is completely dominant, non-allelic and independently inherited to other mildew resistant genes Ml-h and Ml-n present in Hanna and Nepal barley genotypes respectively. However, the resistant gene in B5A/1 is either allelic or closely linked to gene Ml-k in Kwan, hence it is located on chromosome 5.

Introduction

A number of the studies on the inheritance of genes conditioning the resistant reaction of barely to powdery mildew (*Erysiphe graminis hordei*) have been reported earlier (Jorgensen & Jensen, 1983; Sethar *et al*, 1987; Sogard & Jorgensen, 1982; Wolfe, 1985; Wolfe *et al*, 1984). In present study, an attempt is made to provide information on a mildew resistant gene in a Nepali barley.

Material and Methods

A six-rowed winter type barley genotype B5A/1 collected from Nepal expressed high degree of resistance to some British powdery mildew (*Erysiphe graminis hordei*) isolates. For determining the relationship of resistant gene in B5A/1 and other barley genotypes, the crosses were made between B5A/1 and Hanna, Nepal and Kwan possessing the resistant gene Ml-h, Ml-n and Ml-k respectively (Wiberg, 1974). The F_2 seed of all crosses was produced on the F_1 plants of each cross grown in 15 cm diameter pots kept in the disease free glasshouse. Mildew isolate AB14 was multiplied on a barley cultivar Universe in a separate section of glasshouse. The seeds of parents, F_1 and F_2 generations were sown separately in 15 cm pots kept on the benches of the same glasshouse at Welsh Plant Breeding Research Institure, Wales, U.K. When the seedlings reached 1-2 leaf stage they were inoculated with the spores of isolate AB14 by shaking the mildewed seedlings of the Universe. The recording of disease reaction of seedlings was done a week after inoculation at the complete development of mildew pustules on susceptible experimental seedlings in glasshouse with temperature ranging from 18°C to 20°C during screening period. The data was compiled and subjected to Chi-square test for testing F_2 generic ratios.

Table 1. Reactions of the parents, F_1 and F_2 generations of the crosses of B5A/1 with other barley genotypes to isolate AB14.

Parents and cross	Gene-ration	Number of plants with reaction type				Ratio expected	P for
		On	1	2	4		X^2
B5A/1 x Hanna	F_1	0	9	0	0		
	F_2	127	40	41	18	9:3:3:1	0.70-0.80
B5A/1 x Nepal	F_1	0	10	0	0		
	F_2	141	43	50	16	9:3:3:1	0-80-0.90
B5A/1 x Kwan	F_1	10	0	0	0		
	F_2	346	0	118	0	3:1	0.75-0.90

Reaction in type B5A/1: On, Hanna, Nepal and Kwan: 2

Results and Discussions

F_1 plants of the cross B5A/1 x Hanna and B5A/1 x Nepal exhibited resistant reaction due to dominance of resistance gene in B5A/1 over resistance gene Ml-h in Hanna and Ml-n in Nepal. F_2 generation of these crosses gave good fit to 9:3:3:1 ratio expected for independent inheritance of two resistance genes, one of them being dominant over the other showing complementary epistatic gene action (Table 1). It was inferred that the resistant gene in B5A/1 is independent and non-allelic to resistant genes Ml-h and Ml-n in Hanna and Nepal barley genotypes respectively. In the cross B5A/1 x Kwan, F_1 plants exhibited resistant reaction also suggesting the complete dominance of resistance gene in B5A/1 over resistance gene Ml-k in Kwan. F_2 generation segregated into two groups of plants, one larger group showing 'On' reaction like B5A/1 and the other smaller group giving reaction type 2, like Kwan in 3:1 ratio. Susceptible plants were not observed in F_2 generation of this cross. F_2 population fitted to 3:1 ratio, which indicated the allelic relationship between two resistant genes carried by parents. It was hence, implied that the resistant gene in B5A/1 is allelic but dominant to the resistant gene Ml-k in Kwan, hence it is located on chromosome 5. Therefore, this gene can be utilized in breeding resistant barley cultivars by adopting the recent approaches for major gene resistance.

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