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SHORT COMMUNICATION

CROSSING INCOMPATIBILITY IN SOME BEAN CULTIVARS UTILIZED IN BRAZIL

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ABSTRACT

In crosses involving common bean cultivars (*Phaseolus vulgaris* L.) that produce large seeds with others that produce small seeds, abnormal development of the hybrid plants has been observed, and no seeds are produced. This apparent barrier limits the spontaneous flow of genes through different cultivars. In a diallel cross involving 11 cultivars, 12 of the 55 hybrids obtained (21.8%) were incompatible. The probable genotypes of the cultivars involved are presented in this paper to enable breeders to cross only compatible materials.

INTRODUCTION

In certain crosses of bean cultivars, F_1 plants have been found to show incompatibility, *i.e.*, their growth becomes "crippled" a few days after germination. This phenomenon was first reported by Davis and Frazier (1964) and its genetic control has been discussed by several investigators (Coyne, 1965; York and Dickson, 1975; Van Rheenen, 1979; Shii *et al.*, 1980; Singh and Gutierrez, 1984). In all cases reported thus far, the incompatibility occurred in crosses involving a cultivar producing large seeds and a cultivar producing small seeds.

Since in the bean breeding programs of Brazil there is a wide diversity in seed size, incompatibility is a common occurrence, with a consequent obvious limitation of

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spontaneous gene flow between the materials. In addition, an incompatible cross mainly represents a loss of time and money. Thus, the genotypic characterization of certain materials in terms of incompatibility genes will permit breeders to avoid incompatible crosses.

MATERIAL AND METHODS

A diallel cross trial was carried out at "Escola Superior de Agricultura de Lavras". Eleven cultivars were used; 4 of these ("CNF 243", "Eriparza", "Diacol Andino", and "Preto 60 Dias") produce large or medium-sized seeds (100 seed weight $>$ 25 g) and the remaining ones ("CNF 10", "CNF 261", "Milionário", "Rio Vermelho", "Carioca-pé-curto", "Carioca 300 V", and "Rio Tibagi") produce small seeds (100 seed weight $<$ 25 g).

The F_1 generation of each of the 55 hybrids was tested in a greenhouse in a fully randomized design with three replications. Each plot consisted of a pot with 3 plants.

Thirty days after germination, the hybrids were tested for incompatibility. Crosses with yellowish plants that had stopped growing were considered incompatible.

RESULTS AND DISCUSSION

Table I shows the crosses that were incompatible. As previously reported in the literature, incompatibility always occurred in hybrids involving a large-seeded and a small-seeded cultivar. It is interesting to point out, however, that the large x small cross was not always incompatible, as was the case, for example, for the small-seeded cultivar Milionário which was compatible with all of the other materials involved.

According to Singh and Gutierrez (1984), two genes (DL_1 and DL_2) are involved in the control of incompatibility and their action is complementary, *i.e.*, the genotype of the small-seeded material is $DL_1DL_1dl_2dl_2$ and the genotype of the large-seeded material is $dl_1dl_1DL_2DL_2$. Thus, in the F_1 generation of a cross, the genotype will be $DL_1dl_1DL_2dl_2$ and the plant will not develop since the two dominant alleles DL_1 and DL_2 are present. On this basis, we may infer that the genotypes of the cultivars are those listed in Table I. The large-seeded materials that showed some incompatibility are $dl_1dl_1DL_2DL_2$, and the small-seeded materials are $DL_1DL_1dl_2dl_2$. In contrast, the materials that did not show incompatibility, such as Milionário, must be $dl_1dl_1dl_2dl_2$.

Table I - Incompatible hybrids (I), mean 100 seed weight and genotypes of the common bean cultivars involved in the diallel cross trial.

Cultivar	Mean 100 seed weight (g)	Genotype	1	2	3	4	5	6	7	8	9	10	11
1.CNF 243	41	$dl_1dl_1DL_2DL_2$		I						I		I	
2.Car. 300 V	20	$DL_1DL_1dl_2dl_2$			I		I						I
3.Eriparza	29	$dl_1dl_1DL_2DL_2$								I		I	
4.CNF 10	22,5	$dl_1dl_1dl_2dl_2$											
5.Diac. Andino	31	$dl_1dl_1DL_2DL_2$								I		I	
6.Milionário	17	$dl_1dl_1dl_2dl_2$											
7.Rio Vermelho	24	$dl_1dl_1dl_2dl_2$											
8.Car. Pé Curto	14	$DL_1DL_1dl_2dl_2$											I
9.CNF 261	29	$dl_1dl_1dl_2dl_2$											
10.Rio Tibagi	15	$DL_1DL_1dl_2dl_2$											I
11.Preto 60 dias	34,5	$dl_1dl_1DL_2DL_2$											

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