Anthracnose Resistance Spectra of Breeding Lines Derived from the Dry Bean Landrace Andecha

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Andecha is a very large white seeded landrace susceptible to races 6 and 38 and with moderate resistance to races 3, 19 and 102 of *C. lindemuthianum*. These five races are the most commonly found in Northern Spain (Ferreira et al., 1998). To protect Andecha against local races of anthracnose, four parallel backcross breeding programs were developed using germplasm lines A252, Sanilac, A321 and A493 as resistance donors and Andecha as the recurrent parent (figure 1). After 6 backcross generations, and selection for resistance to race 38, lines A1258, A1183, A1231 and A1220 were obtained. Molecular marker analysis carried out previously on the parents and the breeding lines, revealed that only a segment of the B4 linkage group (including the *Co-3/Co-9* gene) proceeding from donors A321 and A493 was present in lines A1231 and A1220, respectively, whereas only a segment of linkage group B11 (including the *Co-2* gene) proceeding from donors Sanilac and A252 was present in lines A1183 and A1258, respectively (Méndez-Vigo, 2001; Méndez-Vigo et al., 2005). Lines A2438 and A1699, were obtained from single crosses between lines A1183, A1220 and A1258 (see fig. 1), followed by marker assisted selection in order to pyramid the resistance genes present in linkage groups B4 and B11. The six lines obtained recovered all the phenotypic characteristics present in the recurrent parent Andecha. In this work, we describe the resistance spectra against 18 races of *C. lindemuthianum* displayed by the parents and the resistant lines obtained in the breeding program.

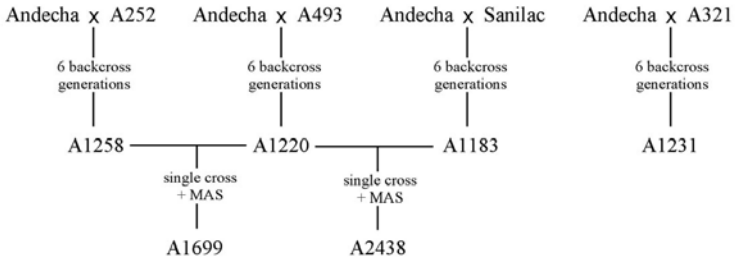

Figure 1. Origin of the breeding lines developed to protect Andecha against local races of anthracnose.

Eighteen races of *Colletotrichum lindemuthianum* were used: races 7, 31, 39, 65, 65 brazil (65b), 73, 81, 357, 449, 1545, 1933 and 2047 from the collection of the Plant and Soil Department (Michigan State University, US), and races 3, 6, 9, 19, 38 and 102 from local isolates of the SERIDA collection. A minimum of ten plants of each line (Andecha, A252, Sanilac, A321, A493, A1258, A1183, A1231, A1220, A2438 and A1699) were inoculated according to standard methods (Pastor Corrales et al., 1994). The responses of the plants were evaluated after 7-9 days using a 1-9 scale where 1 is no visible symptoms and 9 very severely diseased or dead (Van Schoonhoven and Pastor-Corrales, 1987).

Table 1 shows the results of the resistance tests. The comparison of the resistance spectra of each breeding line and its corresponding parents makes possible to predict the most likely locations of some of the genes conferring resistance to the different races.

- **A1258**. Resistance specificities to races 3, 6, 19, 31, 38, 39, 65b and 102 are located on the B11 block, introgressed in line A1258 from donor parent A252, since resistance to these races is added or improved when compared to the Andecha resistance spectrum. Resistance specificities to races 81 and 357, present in A252, were not introduced in A1258, being located somewhere else in the A252 genome.
- **A1183**. Resistance specificities to races 3, 6, 19, 38, 65b, 102, 357 and 449 are located on the B11 block, introgressed in line A1183 from donor parent Sanilac, since resistance to these races is added or

improved when compared to the Andecha resistance spectrum. Resistance specificities to races 39 and 81, present in Sanilac, were not introduced in A1183, being located somewhere else in the Sanilac genome.

- A1220 and A1231. No differences were found in the resistance spectrum showed by these two breeding lines. The resistance spectra of the corresponding donors (A493 and A321, respectively) were also identical. These two donor lines carry the resistance to races 3, 6, 19, 38, 39 and 357 in the B4 block, introgressed in lines A1220 and A1231, since resistance to these races is added or improved when compared to the Andecha resistance spectrum. Resistance to race 31 would be provided by other resistance gene, as it was not introgressed in the breeding lines. Recurrent parent Andecha carries a gene conferring partial resistance to race 449 on B4 linkage group, since resistance to this race disappears in breeding lines A1231 and A1220 when replaced by the introgressed B4 block, comming from their corresponding donor parents A321 and A493, respectively. Moreover, Andecha has a gene (or genes) conferring resistance to races 65b and 1933, not located on B4, as breeding lines A1231 and A1220 remain resistant to these races after the replacement of the B4 block from their corresponding donors (which are susceptible to these two races).

- A2438 and A1699. These two lines were the result of pyramiding resistance genes in lines A1183 and A1220 (A2438) and in lines A1258 and A1220 (A1699). The evaluation of A1699 for resistance against some of the races is still under progress. The resistance spectrum in both lines seems to be the addition of the resistance specificities of the corresponding parent lines. The resistance analysis carried out in this work revealed that all parent lines have at least two different genes or clusters conferring resistance to the 18 anthracnose races tested.

Table 1. Resistance spectra against 18 races of *C. lindemuthianum*, displayed by the materials involved in the breeding program shown in figure 1. RP: recurrent parent; DP: resistance donor parents; BL: breeding lines; PL: lines obtained by pyramidation. R: resistant; R*: partial resistance; S: susceptible

		Races										
	Lines	7, 9, 65, 73, 1545	3, 19, 102	6, 38	31	39	65b	81	357	449	1933	2047
RP	Andecha	R	R*	S	S	S	R*	R*	S	R*	R	S
DP	A252	R	R	R	R	R	R	R	R	R*	R	S
BL	A1258	R	R	R	R	R	R	R*	S	R*	R	S
DP	Sanilac	R	R	R	S	R	R	R	R	R	R	S
BL	A1183	R	R	R	S	S	R	R*	R*	R	R	S
DP	A321	R	R	R	R	R	S	R*	R	S	S	S
BL	A1231	R	R	R	S	R	R*	R*	R*	S	R	S
DP	A493	R	R	R	R	R	S	R*	R	S	S	S
BL	A1220	R	R	R	S	R	R*	R*	R*	S	R	S
PL	A2438	R	R	R	S	R	R	R*	R*	R	R	S
PL	A1699	-	R	R	R	-	-	-	R*	-	-	-

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