GENOTYPING OF COMMON BEAN CULTIVARS WITH MOLECULAR MARKERS LINKED TO DISEASE RESISTANCE GENES AS SUPPORT FOR GENE PYRAMIDING PROCESS

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One of the important factors hindering common bean productivity and performance is the occurrence of diseases. Angular leaf spot, caused by *Pseudocercospora griseola*, anthracnose, caused by *Colletotrichum lindemuthianum* and rust, caused by *Uromyces appendiculatus* are among the most important common bean diseases. In the integrated management of diseases, one of the strategies adopted is the use of resistant cultivars. They are usually developed by transferring resistance alleles from exotic sources to elite cultivars (ALZATE-MARIN et al., 2005). Cultivars with different resistance genes can be intercrossed to associate (pyramid) several resistance genes in the same genetic background. This is used to develop cultivars with durable and broad spectrum resistance. This strategy is extremely difficult to accomplish mainly due to limitations concerning the proper identification of resistant/susceptible plants after multiple inoculations with different pathogens. Molecular markers closely linked to resistant genes can be useful for the indirect selection of the resistance alleles, particularly in the initial and intermediate phases of the breeding process.

The objective of the present work was to genotype common bean cultivars used in bean breeding programs in Brazil with molecular markers linked to resistance genes to angular leaf spot, anthracnose and rust. This is a crucial step for the rational use of the gene pyramiding concept.

Leaf DNA samples were extracted (DOYLE & DOYLE, 1990) from 19 common bean genotypes and amplified with the following dominant SCAR markers $F10_{1050a}$, $BA08_{560a}$, $AA19_{651a}$, $BA16$, $N02_{950a}$, $H13_{520a}$, $Y20_{830a}$ and $AZ20_{845a}$ (Table 1).

The results shown in Table 1 demonstrate that different breeding strategies can be planned involving the genotypes tested. For instance, cultivar BRSMG-Talismã, which does not possess the alleles for angular leaf spot resistance (*Phg-ON* and *Phg-3*), presents the markers for these two allelles (BA16 and N02, respectively). These observations hinder the use of such markers for monitoring the introgression of these alleles into cv. BRSMG-Talismã. SOUZA et al. (2005) showed that cultivar BRSMG-Talismã is susceptible to several races of *P. griseola*, *C. lindemuthianum* and *U. appendiculatus*, indicating this cultivar does not possess many resistant alleles for these three pathogens. Other "carioca-type", as well as black and red seeded common bean cultivars tested also presented unexpected band patterns for some of the markers evaluated. This demonstrates the need for validation of each marker, case by case, aiming at different possibilities of intercrossing.

The results achieved in this work will give support for the design of future strategies of resistance gene pyramiding in breeding programs in Brazil.

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Table 1. DNA amplification of elite lines and cultivars of interest for strategies of gene pyramiding, using SCAR markers

Line/Cultivar	Group	Resistance Genes	Molecular marker and linked gene(s)							
			F10 Ur-ON and Co-10	BA08 Ur-ON and Co-10	AA19 Phg-ON	BA16 Phg-ON	N02 Phg-3	H13 Phg-1	Y20 Co-4	AZ20 Co-6
MAR-2		Phg-4 and/or Phg-5²	-	-	+	-	+	-	-	+
BAT 332		Phg-6²	+	+	+	+	+	-	-	-
Mexico 54		Phg-2 and/or Phg-5 and/or Phg-6	+	-	+	-	+	-	-	+
Cornell 49-242		Phg-3	+	+	-	+	+	-	-	-
AND 277		Phg-1, Phg-2², Phg-3² and Phg-4²	-	-	+	+	+	+	-	-
Ouro Negro	Black	Ur-ON, Co-10 and Phg-ON	+	+	+	+	-	-	-	+
Diamante Negro	Black	?	-	-	-	-	-	-	-	-
Valente	Black	?	+	+	-	-	-	-	-	+
BRSMG-Talismã	Carioca	?	-	-	-	+	+	-	-	-
Pérola	Carioca	?	-	-	-	-	+	-	-	-
Pérola "R"	Carioca	Ur-ON, Co-4, Co-6, Co-10 and Phg-1	+	+	+	+	+	+	+	+
P-45-3-29-44	Carioca	Ur-ON, Co-10 and Phg-ON	+	+	+	+	+	+	-	-
Rudá "R"	Carioca	Ur-ON, Co-4, Co-6, Co-10 and Phg-1	+	+	+	+	+	+	+	+
MAR-138-1-11-4	Carioca	Phg-4 and/or Phg-5²	-	-	+	-	+	-	-	-
BAT-68-9-6	Carioca	Phg-6²	-	-	+	+	-	-	-	-
MEX-37-3-6-3	Carioca	Phg-2 and/or Phg-5 and/or Phg-6	-	-	+	-	+	-	-	-
Rudá	Carioca	?	-	-	-	-	-	-	-	-
Ouro Vermelho	Red	?	-	-	-	-	-	-	-	-
Vermelhinho	Red	?	-	-	-	-	-	-	-	-

(+): presence of the band, (-): absence of the band; (?): genes not characterized or absent

159