Structural homologues of CC-NBS-LRR genes for potato late blight resistance in wild Solanum species

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New cases of Phytophthora infestans rapidly defeat potato late blight (LB) resistance based on pepermplasm transferred from Solanum demissum, so breeders search for new sources of durable LB resistance in genetic collections of wild Solanum species. SCAR markers for five races-specific genes initially characterized in S. demissum and S. bulbocastanum (R1, R2/Rp1/b1, Rs3 and R/Rp3/b1) were employed to screen a collection of wild Solanum accessions representing six series from section Pota and clones developed from these accessions. The patterns thus produced will facilitate further mining for new R genes for LB resistance and promote the evolutionary studies of CC-NBS-LRR resistance genes.

Markers and their sites, hp/Clone marker Chromosome Position in the prototype clone References

| RS-69 | AYM36128 | 8 | 595-1223 | [1] |
| RS-226 | AYM36128 | 8 | 3143-3308 | [2] |
| Rl-B22 | AYM36128 | 8 | 2547-3143 | [3] |
| Rl-1202 | AYM36128 | 8 | 5126-6311 | [1] |
| Rl-2500 | FJ563325 | 4 | 1-2588 | [4] |
| Rs3-1300 | AYM493582 | 11 | 1677-3056 | [1] |
| Rs3-378 | JF909492 | 11 | 94818-9515 | [1] |

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When using this evidence for selecting the genotypes of paramount interest for further breeding program, a crucial problem is the functional identity of newly found CC-NBS-LRR homologues. In some cases, we have supported the evidence for new alleles of the R gene in orphan Solanum species by cloning and sequencing [1], while other laboratories provide even more convincing data from co-expression studies in Nicotiana benthamiana and potato transformation.

Closed markers Rs1-1205 in S. polytrichon and S. tuberosum and Rs3-1800 in S. bulbocastanum, S. cardiophyllum, S. hougasii, S. polytrichon, S. stoloniferum, S. demissum, S. macrodontum, and S. tuberosum were selected for functional gene analysis in the R3-1800 fragments from wild Solanum species sequenced in our laboratory when compared to those of the demissum Rf gene, tomato 11 gene and Rs2-like inactivable homologues from the NCI Genome Bank [38-40] of the Rs3-1800 sequences belonged to the same cluster as Rs3 presuming that they represented the active genes [1].

Cluster 1, haplotypes that joined with functional R/Rp3/b1 gene cluster 2, pseudogenes, except for 1122 haplotype; cluster 3, S. polytrichon-specific haplotype; cluster 4, other haplotypes.

Maximum-likelihood tree comparing the Rs3-1800 sequences from wild Solanum species (in brackets) to the functional gene Rf, gene 12 and Rs3 pseudogenes.

When RB-629 was cloned from 16 accessions representing 12 wild Solanum species, pattern of polymorphisms was neither species nor sero-specific, and we conclude that observed diversity of RB-629 has emerged before Solanum specification. The marker RB-226 was found only in the cluster 1 genotypes, Marker presence and particular haplotypes were not immediately associated with high LB resistance [7].