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Multiple R genes and phenolic compounds synthesis involved in the durable resistance to *Phytophthora infestans* in potato cv. Cooperation 88

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Abstract Late blight (LB), *Phytophthora infestans* (PI) as pathogen, is the most devastating disease limiting potato production globally. In the Tropic highlands it can reduce yields by more than 50%. Cooperation-88 (C88) is a potato variety with high levels of durable resistance to PI, even after being widely grown for over 20 years. To more fully understand the mechanism of the resistance to PI of this variety, we inoculated detached leaves of young C88 plants with PI isolate XA-4 (super race with vir 1-11). Samples of one day post pathogen inoculation (1 dpi), 3 dpi, 5 dpi and control treated with sterile water were collected and frozen with liquid nitrogen. Transcriptomes of these 4 samples were sequenced by the next-generation sequencing platform Illumina Hiseq 2000. Totally ~68 M clean reads were obtained. With the genome of *S. phureja* clone DM1-3 516R44 as reference, these clean reads were processed by GO analysis, KEGG pathway enrichment analysis and differential expression analysis. PI inoculation of C88 leaves resulted in the following: a) in the 3 pathogen inoculated samples, 3,950 were differentially regulated compared to those in the control; c) at 1 dpi increased expression genes were nearly double the number of decreased expression genes; d) 665 genes were differentially expressed in every treatments; e) gene expression levels in photosynthesis and the chloroplast were mostly diminished. The high durable late blight resistance C88 is composed of: a) 344 expressed R genes; b) 9 pathogenesis-related genes, particularly osmotin gene and endochitinase gene expressions increased dramatically with PI inoculation; c) Thirty genes for phenolic compounds synthesis expressions increased with PI inoculation from small to large multiples compared to the control; and d) R genes need pathogenesis proteins and phenolic compounds to have superior durable resistance to PI.

Keywords digital expression profiling; potato; Cooperation 88; late blight resistance; R genes; pathogenesis-related proteins; phenolic compounds

Abbreviation list

3GT: anthocyanidin 3-O-glucosyltransferase

5GT: anthocyanidin 5-O-glucosyltransferase

A5AAT: anthocyanin 5-aromatic acyltransferase

AAT: anthocyanin acyltransferase

ACX1: acyl-CoA-oxidase 1

AGT: anthocyanin glucosyltransferase

ANP: anthocyanin permease

ANS: anthocyanidin synthase

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