Urease affects soybean susceptibility to fungi

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The soybean ubiquitous urease, encoded by GmEu4 gene, is known for recycling metabolically-derived urea. However, additional biological roles of plant ureases have been recently demonstrated, especially in defense against fungi and insects attack. In the present study, the relevance of GmEu4 in soybean response to fungi was investigated through overexpression and silencing approaches. First, GmEu4 expression profile over the course of Phakopsora pachyrhizi infection was determined by RT-qPCR. A differential expression pattern was found in susceptible and resistant genotypes, especially 24 h after inoculation. Transcript levels were up-regulated in resistant genotype and down-regulated in susceptible one. GmEu4 full length ORF was cloned into pH7WG2D, designed for gene overexpression in plants. Soybean somatic embryos were submitted to transformation via particle bombardment and bombardment/Agarobacterium system. A total of thirty adult, transgenic soybean plants, representing seven independent transformation lines, were obtained. A single transgenic line exhibited the intending overexpression and enhanced ureolytic activity. Most transgenic plants showed GmEu4 co-suppression and decreased ureolytic activity. Progeny was obtained from GmEu4 co-suppressed plants. The growth of Rbizoctonia solani, Phomopsis sp., Fusarium solani, Colletotrichum gosypii and Penicillium herguei in media containing crude protein extract from either transgenic or non-transgenic leaves was evaluated. Protein extracts from the overexpressing plant inhibited fungal growth compared to extracts from non-transgenic plants, while in extracts from co-suppressed plants fungal growth was higher than extracts from non-transgenic controls. Additionally, when infected by P. pachyrhizi uredospores, detached leaves of GmEu4 co-suppressed plants developed a significantly higher number of lesions, pustules and erupted pustules than leaves containing normal levels of the enzyme (non-transgenic plants). Altogether our results confirm the importance of soybean ubiquitous urease in plant defense against a wide range of fungi and suggest that genetic manipulation of this gene represents an alternative for soybean resistance to fungi.

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