GENERATION OF WALNUTS ENGINEERED WITH RICE BACTERIAL BLIGHT RESISTANCE GENES

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ABSTRACT

Recent work in several laboratories indicates that disease resistance genes are related and can confer resistance to diverse pathogens. Interestingly, not only are the plant genes related (between monocots and dicots) but the pathogen "avirulence determinants" are also highly similar. These results suggest that transfer of resistance genes between crop species may lead to effective resistance. To test this idea, we have transferred the recently cloned rice bacterial blight resistance gene, Xa21, to walnut. Preliminary results suggest that the resulting embryos are transformed. Inoculation of the transgenic walnut embryos will allow us to determine if we have engineered resistance to bacterial blight disease in walnut.

OBJECTIVE

Naturally occurring disease resistance remains the most economical method of disease control. However, for some diseases, such as bacterial blight disease of walnut, genetic resistance is not currently available in California cultivars. Recently, several disease resistance genes have been cloned. We have isolated gene from rice encoding resistance to bacterial blight (Xanthomonas oryzae pv. oryzae). With this discovery, it is now possible to begin experiments directed at engineering walnut for resistance to walnut blight (Xanthomonas campestris pv. juglandis).

The long-term goal of this project is to develop walnut lines that are resistant to bacterial blight disease. We propose to use gene transfer strategies to test the effectiveness of the rice gene Xa21 and its derivatives for its ability to confer bacterial blight resistance in walnut.

PROCEDURE

The rice gene Xa21 was subcloned into the appropriate E. coli shuttle vectors and transferred to Agrobacterium. Embryos transformed with Agrobacterium containing Xa21 were selected on kanamycin. Kanamycin resistant embryos will now be tested for presence of the Xa21 gene and inoculated with X. c. juglandis to assay for resistance to bacterial blight.

RESULTS AND CONCLUSIONS

Although there are still a limited number of agronomically important genes available for use in plant transformation studies, this situation is changing rapidly. For example, there are already genes for insect and herbicide resistance in use in transgenic plants. In
the last three years, several plant disease resistance genes have been cloned. Manipulation of the sequence of these genes may lead to resistance to pathogens such as bacterial blight. We have initiated a collaboration with G. McGranahan and A. Dandekar to transfer the rice gene, *Xa21* into California walnut cultivars.

We will test the transgenic embryos for resistance to bacterial blight. The results of these experiments will tell us if we have successfully engineered resistance in walnut. If so, these lines will be directly useful in California. If not, we will continue to examine and manipulate the domains of the rice gene that are promising targets for future genetic engineering of disease resistance in walnut.