

Controlling insect pests with bacterial genes

A visit by Phil Dix to Vietnam several years ago led to this fruitful collaboration between two Irish laboratories and researchers in Ho Chi Minh City. Support, initially from CIDSE (an international aid organisation), and subsequently from the Department of Foreign Affairs, enabled a student, Lao Thi Nga, to come to Ireland to work on the project. The objective of the research was to clone insecticidal protein genes (cry) from the soil bacterium *Bacillus thuringiensis* and to introduce them into *Brassica* species, particularly cauliflower, with a view to reducing the need for chemical spraying against Lepidopteran pests (caterpillars) in these important vegetable crops. Cry proteins, the cry gene products, are cleaved in the insect gut to give activated toxins which specifically bind to sites in the gut of target groups of insects. They are completely harmless for non-target insects and other animals. Spore preparations of *B. thuringiensis* have been used commercially as a biological insecticide for more than 30 years.

A particular cry gene, *cryIIIB*, with specific activity against Lepidopteran species, was the focus of the present study. It was cloned from a Vietnamese strain of *B. thuringiensis* and used to produce a number of gene constructs, with different expression signals. These were in turn transferred to the natural plant transformation agent *Agrobacterium tumefaciens*, and initially used to transform tobacco by cultivation of leaf strips with *A.*



Tobacco hornworm caterpillars feeding on a control tobacco leaf (left) and one transformed with *cryIIIB* gene (right).

tumefaciens. This enabled the expression of the different gene constructs to be evaluated in a convenient higher plant system before embarking on the more difficult task of transforming cauliflower.

Integration, and inheritance of the *cryIIIB* gene, have now been confirmed in tobacco plants, and its effectiveness against a tobacco pest (tobacco hornworm) demonstrated (see Figure).

Meanwhile a transformation system has also been developed for cauliflower, using seedling material, and so far a single transformant containing the *cryIIIB* gene has been obtained. Further work will be aimed at obtaining more transgenic cauliflower plants carrying insecticidal genes, subjecting them to rigorous molecular and genetic characterisation, and examining the effect of the transgene on insect predation in bioassays. Ø