

# Cellular and Molecular Mechanisms of Pathogen Derived Resistance Against TMV in Transgenic Plants

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"Pathogen derived resistance" (PDR) is a term that is used to describe the use of transgenes that are derived from genes of pathogens to confer resistance against the pathogen from which the gene was taken. PDR has been used extensively to develop transgenic plants that are resistant to virus infection, including the use of genes that encode coat protein (CP) and dysfunction movement protein (dMP), and replicases, and those that produce RNA sequence but do not encode a protein.

Our studies of CP-mediated resistance (CP-MR) and dMP-mediated resistance have concentrated primarily on studies of tobacco mosaic tobamovirus (for review, see Fitch and Beachy, 1993). In studies of CP-MR it has been demonstrated that altering the capacity of CP subunits to assemble to form a "tight" vs a "loose" helix can influence the degree of resistance to TMV (Clark et al., 1995a). On the other hand, structural changes that alter the surface structure of the CP but do not affect the capacity of the CP to assemble do not alter CP-MR (Clerk *et al.*, 1995b).

Recently it was shown that a specific mutation in the MP of TMV that renders it dysfunctional (*i.e.*, unable to facilitate the local spread of TMV) creates a dMP which, when produced in transgenic plants, confers resistance to TMV and other tobamoviruses (Lapidot *et al.*,

1993). Furthermore one such dMP confers resistance to tobacco against a number of non-tobamoviruses (Cooper *et al.*, 1995). We suggest that the dMP derived from TMV interferes with a cellular or molecular function that is common amongst other movement proteins, thereby rendering their capacity to spread the infection of the challenge virus.

This presentation will present our recent data related to cellular and molecular mechanism of CP and dMP mediated resistance against TMV. It will also describe the activities in the International Laboratory of Tropical Agricultural Biotechnology (ILTAB), where PDR are applied to control rice tungro virus disease of rice and other plant viral pathogens in developing countries.

## References

- Clark, W.G., Firchen, J., Nejidat, A. and Beachy, R.N. 1995b Studies of coat protein-mediated resistance to TMV : II. Challenge by a mutant with altered virion surface does not overcome resistance conferred by TMV CP. *J. Gen. Virol.* (in press)
- Clark, W.G., Firchen, J.H. and Beachy, R.N. 1995a Studies of coat protein-mediated resistance to TMV using mutant CP : I. The PM2 assembly defective mutant. *Virology* (in press)
- Cooper, B., Lapidot, M., Heick, J.A., Dodds, J.A. and Beachy, R.N. 1995, Multi-virus resistance in transgenic tobacco plants expressing a dysfunctional movement protein of tobacco mosaic virus. *Virology* 206:307-313
- Firchen, J.H. and Beachy, R.N. 1993. Genetically engineered protection against viruses in transgenic plants. *Annu. Rev. Microbiol.* 47:739-763
- Lapidot, M., Gafny, R., Ding, B., Wolf, S., Lucas, W.J. and Beachy, R.N. 1993. A dysfunctional movement protein of tobacco mosaic virus that partially modifies the plasmodesmata and limits virus spread in transgenic plant. *The Plant Journal* 2:959-970