

Assessing the Susceptibility of Cruciferous Lepidoptera to Cry1Ba2 and Cry1Ca4 for Future Transgenic Cruciferous Vegetables

A. M. Shelton,^{1,2} G. T. Gujar,³ M. Chen,¹ A. Rauf,⁴ R. Srinivasan,⁵ V. Kalia,³ A. Mittal,³ A. Kumari,³ K. Ramesh,³ R. Borkakatti,³ J. Z. Zhao,^{1,6} N. Endersby,⁷ D. Russell,^{7,8} Y. D. Wu,⁹ and B. Uijtewaal¹⁰

¹ Department of Entomology, Cornell University/NYSAES, Geneva, NY 14456.

³ Division of Entomology, Indian Agricultural Research Institute, New Delhi 110012, India.

⁴ Department of Plant Protection, Bogor Agricultural University, Indonesia.

⁵ AVRDC-The World Vegetable Center, Taiwan 74151.

⁶ Current address: Pioneer Hi-Bred International Inc., 7300 NW 62nd Ave., P.O. Box 552. Johnston, IA 50131.

⁷ Department of Genetics, University of Melbourne, Parkville, VIC 3010 Australia.

⁸ Natural Resources Institute, University of Greenwich, Chatham, Kent ME4 4TB, United Kingdom.

⁹ Department of Entomology, Nanjing Agricultural University, Nanjing 210095, China.

¹⁰ Nunhems BV, Haelen, The Netherlands.

² Corresponding author, e-mail: ams5@cornell.edu.

Abstract

Advances in transgenic plants expressing *Bacillus thuringiensis* (Bt) insecticidal gene (s) offer a promising alternative to traditional insecticides for control of lepidopteran pests on important cruciferous vegetable crops such as cabbage and cauliflower. A public-private partnership, the Collaboration on Insect Management for Brassicas in Asia and Africa (CIMBAA), was formed in 2005 with the goal of developing dual-gene Bt cauliflower and cabbage, initially for India, to replace the use of broad spectrum, traditional insecticides. As a first step in this effort, the major lepidopteran pests of cruciferous vegetable crops [*Plutella xylostella* (L.), *Pieris rapae* (L.), *Pieris brassicae* (L.), *Crociodolomia binotalis* (L.), *Hellula undalis* (F.), *Diacrisia obliqua* Walker, *Spodoptera litura* F., and *Helicoverpa armigera* (Hübner)] were collected over a large geographic area (India, Indonesia, Taiwan, China, Australia, and the United States) and tested against purified Cry1Ba2 and Cry1Ca4 toxins, the toxins proposed to be expressed in the CIMBAA plants. Our results demonstrate that Cry1Ba2 and Cry1Ca4 were effective against the primary target of the CIMBAA plants, *P. xylostella*, regardless of geographic location, and had LC₅₀ values <1.3 ppm. Furthermore, one or both toxins were effective against the other major pest Lepidoptera, except for *S. litura* or *H. armigera* which were less susceptible. No cross-resistance has been found between Cry1Ba2 and Cry1Ca4, suggesting *cry1Ba2+cry1Ca4* cauliflower and cabbage could be an effective and sustainable tool to control, *P. xylostella*, the key lepidopteran pest on cruciferous vegetable crops, as well as most other Lepidoptera. As the CIMBAA plants are being developed, further tests are needed to determine whether they will express these proteins at sufficient levels to control all the Lepidoptera. Sustainable use of the dual-gene plants also is discussed.

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