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Development of a viral biopesticide for the control of the Guatemala potato tuber moth *Tecia solanivora*

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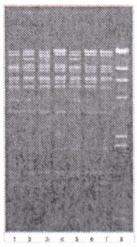
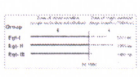
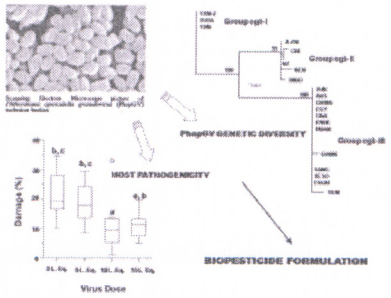




Abstract

The Guatemala potato tuber moth *Tecia solanivora* (Povolny) (Lep. Gelechiidae) is an invasive species from Mesoamerica that has considerably extended its distribution area in recent decades. While this species is considered to be a major potato pest in Venezuela, Colombia, and Ecuador, currently no specific control methods are available for farmers. To address this issue we developed a biopesticide formulation to be used in integrated pest management of *T. solanivora*, following three steps. First, search for entomopathogenic viruses were carried out through extensive bioprospections in 12 countries worldwide. As a result, new *Phthorimaea operculella granulovirus* (PhopGV) isolates were found in *T. solanivora* and five other gelechid species. Second, twenty PhopGV isolates, including both previously known and newly found isolates, were genetically and/or biologically characterized in order to choose the best candidate for a biopesticide formulation. Sequence data were obtained for the ecdysteroid UDP-glucosyltransferase (*egt*) gene, a single copy gene known to play a role in pathogenicity. Three different sizes (1086, 1305 and 1353 bp) of *egt* were found among the virus isolates analyzed. Unexpectedly, no obvious correlation between *egt* size and pathogenicity was found. Bioassays on *T. solanivora* neonates showed a maximum of a 14-fold difference in pathogenicity among the eight PhopGV isolates tested. The most pathogenic PhopGV isolate, JLZ9f, had a medium lethal concentration (LC_{50}) of 10 viral occlusion bodies per square mm of consumed tuber skin. Third, we tested biopesticide dust formulations by mixing a dry carrier (calcium carbonate) with different adjuvants (magnesium chloride or an optical brightener or soya lecithin) and different specific amounts of JLZ9f. During laboratory experiments, satisfactory control of the pest (>98% larva mortality compared to untreated control) was achieved with a formulation containing 10 macerated JLZ9f-dead *T. solanivora* larvae per kg of calcium carbonate mixed with 50 mL/kg of soya lecithin. The final product provides an interesting alternative to chemical pesticides for Andean farmers affected by this potato pest.

Graphical abstract



Highlights

► New *Phthorimaea operculella granulovirus* (PhopGV) isolates were found. ► At least six gelechid species are natural hosts for PhopGV. ► Three sizes of the pathogenicity-related gene *egt* were found among PhopGV isolates. ► The virus isolates also exhibited large variation in their pathogenicity. ► A PhopGV-based formulation efficiently controlled *Tecia solanivora* larvae.

Keywords

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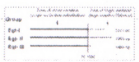
Figures and tables

Table 1
Table 2



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