



Enterotoxin-Deficient *Bacillus* Strains for Use as Biocontrol Agents

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WARF: P08212US02

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing *Bacillus* strains that have been modified so they do not produce enterotoxin products that are associated with human toxicity.

Overview

Bacillus thuringiensis, which produces several proteins that are specifically toxic to plant pests, is used widely as an agricultural biocontrol agent. However, concern about the widespread use of *B. thuringiensis* on food crops is growing because *B. thuringiensis* is closely related to *B. cereus*, a known food contaminant that can cause diarrhea in humans due to the expression of enterotoxin genes. Most commercial *B. thuringiensis* strains also contain and express enterotoxin genes.

The major difference between *B. thuringiensis* and *B. cereus* appears to be the presence of plasmids in *B. thuringiensis* that encode an insecticidal crystal toxin. Therefore, constructing enterotoxin-deficient mutants of existing commercial *B. thuringiensis* strains should enhance the safety of *B. thuringiensis* for food crops while maintaining its effectiveness as a biocontrol agent.

UW–Madison researchers previously developed methods for making *Bacillus* strains in which a component of the HBL enterotoxin is disrupted. However, while these strains demonstrated reduced enterotoxin activity, they continued to exhibit low levels of enterotoxin.

The Invention

UW–Madison researchers have now created improved mutants of *B. thuringiensis* for use as bioinsecticides on food crops. In the modified strains, four distinct operons, each comprising three genes that encode unique enterotoxins that have been implicated in food poisoning, have been replaced with copies containing deletions, rendering the enterotoxins non-functional. The quadruple enterotoxin-deficient strains do not produce the enterotoxin products that are associated with human toxicity, yet perform as well as the wild-type *B. thuringiensis* strain.

Applications

- Use of *B. thuringiensis* as an agricultural biocontrol agent

Key Benefits

- Removes the enterotoxin products associated with human toxicity, improving the *B. thuringiensis* strain for use as a biocontrol agent
- Performs as well as the wild-type strain
- Does not include any added DNA and therefore is not considered genetically engineered by the Environmental Protection Agency

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Stage of Development

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The quadruple enterotoxin-deficient strain performed as well as the wild-type strain in insect bioassays.

Additional Information

For More Information About the Inventors

- [Jo Handelsman](#)

Related Technologies

- [WARF reference number P98184US describes enterotoxin-deficient *Bacillus* strains obtained by altering at least one of the three polynucleotide sequences that encode a component of the HBL enterotoxin.](#)

Related Intellectual Property

- [View Continuation Patent in PDF format.](#)

Publications

- Klimowicz A.K., Benson T.A. and Handelsman J. 2010. A Quadruple-Enterotoxin-Deficient Mutant of *Bacillus thuringiensis* Remains Insecticidal. Microbiology 156, 3575-3583. [Epub September 9, 2010]

Tech Fields

- [Animals, Agriculture & Food : Plant health](#)

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