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Role of Bt Gene in Vegetable Crops

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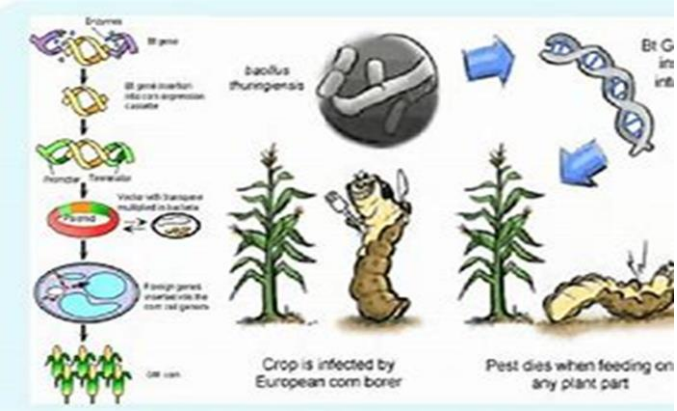
INTRODUCTION

One of the most successful current agricultural defenses against plant-eating insects is Bacillus thuringiensis (Bt), which can be injected onto the plant's surface to offer short-term protection or inserted genetically to give the plant lifelong protection from insects. Targeted pest species are concerned about the toxic Bt crystal protein (CP), which is produced by genetically engineered plants. An insect that feeds on the plant and ingests CP suffers the same effects as if Bt had been sprayed on the leaf tissue. Commercial crops expressing Bt toxins have gained popularity recently due to their cost-effectiveness and ability to protect plants. On the other hand, Bt plants' effects on non-target species and insects' resilience to plant defensive mechanisms are considered negatives.



Biological Feature of Bt

About 112 years ago, in 1901, Ishwata discovered Bacillus thuringiensis (Bt) in silkworm larvae. Bt is a type of insecticide sprayed on crops that contains similar protein crystals along with spores. Because it produces crystalline-shaped proteins that are effective against particular insect species, Bt is unique.

Bt Mode of Action

One unique feature of B. thuringiensis bacteria that gives them activity against particular insect species is their synthesis of crystalline proteins. The main cause of Bt's insect repellent properties is D-endotoxin. In contrast to most insecticides, Bt insecticides whether administered topically or included in genetically engineered plants don't act upon contact. What gives Bt its insecticidal characteristics are the crystal proteins (CPs) that the bacteria manufactures during the sporulation stage of its life cycle. These proteins are inactive at this point. The crystals must be discharged into an alkaline (pH more than 9) environment in order for them to become active. Protease, which interacts with the midgut epithelium during digestion, has the ability to change the CPs into the active toxin. The process could take hours or even days; this is a little bit longer than what is required for synthetic insecticides to kill insects.

Bt Applications-

Bt Preparations- The vast majority of Bt preparations consist of mixtures of spores and associated protein crystals.

Biotechnology of Bt Products- The variety of uses and duration of effect of Bt products can be increased by using innovative molecular biology approaches (Cannon, 1995; Gelernter and Schwab, 1993). When toxin crystals are transferred into other genetic systems, like the non-sporulated bacteria Pseudomonas fluorescens, the toxin can live longer after application since it is considerably more resistant to breakdown processes (Schnepf et al., 1998). To ensure a complete defense against stem borers, more toxin genes were inserted into bacteria, such as Clavibacter xyli.

Transgenic Bt-Plants- The remarkable finding that different microorganisms, animals, and plants can exchange DNA marked the beginning of the story. This discovery allowed scientists to locate the gene that produces the insect-lethal Bt protein and transfer it into crop plants. Transgenics is the term used to describe these altered plants. Therefore, it is possible to produce the toxic Bt crystal protein (CP), which kills the intended pest species, by genetically modifying plants.

Public Acceptance of Bt Vegetable

Vegetables are essential for well-balanced meals because they supply a range of essential components that are lacking from basic crops such as rice, wheat, and corn. There is evidence that eating a diet rich in vegetables can also help with digestion, improve vision, and lower the risk of heart disease, strokes, and several types of cancer. 5 Long-term Chinese studies have shown that plant-based diets extend life and that vegetables help fight the "Hidden Hunger" of malnutrition. In addition to the benefits they offer to customers, farmers who cultivate vegetables usually earn five times more per capita in farm income than farmers who grow cereals.

Labeling Issues

Labeling is another problem that is often discussed in regard to biotechnology in the food chain. As to the IFIC poll, there is generally a high level of consumer satisfaction with the information provided on food labels. 82% of people surveyed say they are at a loss for further information that ought to be included on the label. Out of the eighteen percent who felt that more information should be on the label, only three percent mentioned biotechnology. But if a well-funded anti-biotech campaign spread misleading information about genetically modified crops, I think this could change.

Regulatory Issues

In addition to the labeling difficulties already mentioned, regulatory issues also impact the commercialization of Bt crops. As per the extant international regulatory structure, as delineated by Matten et al., the registration of Bt vegetables requires an assessment of the insecticidal trait's effect on non-target organisms along with other possible adverse environmental effects, such as the emergence of pest resistance.

This would greatly simplify the process of cultivating insect-resistant crops, such as Bt vegetables, which are critically needed.

Bt Potatoes

Cultivars of potatoes that expressed the Bacillus thuringiensis var tenebrionis Cry 3A toxin were the first to be certified for human consumption and conferred resistance against the Colorado potato beetle. Known as Leptinotarsa decemlineata Say (cv NewLeafTM, Monsanto Corp.), these cultivars were also the first to be commercially produced genetically modified crop in the United States (1995). The Bt cry3A potatoes were introduced in 1997 combined with resistance to either the potato virus Y or the potato leaf roll virus. These potatoes were referred to as NewLeafTM Y and NewLeafTM Plus, respectively.

Sweet Corn

Sweet corn has proven to be the most successful Bt crop to far, despite a difficult history. In 1998, Novartis Seeds introduced it to the United States market. It was predicated on event Bt 11, which was registered for field corn as early as 1996 and expresses Cry1Ab.

Crucifers

Cry1 Bt genes have been inserted into several Brassica species, according to Shelton et al. (2008). This has given the species resistance to various Lepidoptera and the diamondback moth, Plutella xylostella (L.), which is the main insect pest of crucifers worldwide. First, our program used Bt brassicas as a research tool to study insecticide resistance management (IRM) strategies, since P. xylostella was the only insect to have evolved resistance to Bt foliar sprays in the field.

Eggplant

Shelton provided a summary of the history of the jalapeño, or Bt eggplant, in India.39 Solanum melongena, or eggplant, is a popular vegetable grown on 560,000 hectares in India in 2008.Forty In India, the most popular veggies are tomato and onion, but eggplant is regarded as the most affordable. Because of this, it is a staple of numerous cuisines that are loved across the nation. Like other crops in the solanaceous family, eggplant can be affected by a range of pests and diseases, but the most harmful is the fruit and shoot borer (FSB), Leucinodes orbonalis.

CONCLUSION

The synthesis of D-endotoxin is the main cause of the insect-pathogen bacteria Bacillus thuringiensis (Bt). This diverse genus has about 20 more Bacillus species in addition to hundreds of different subspecies. Soil bacteria are often defined as Bacillus species. Numerous terrestrial settings, including soil, granaries, dead and living insects, and plant surfaces, are home to Bt. After being consumed by a vulnerable host, a part of the crystal binds to certain gut receptors, entering the digestive tract and rupturing the intestinal lining cells to kill the host.

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