Monitoring the presence of genetically modified potato EH92-527-1 (BPS-25271-9) in commercial processed food

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Abstract

The Amflora (EH92-527-1) potato is a genetically modified (GM) potato in which only starch of the amylopectin form is produced. This has been achieved by intervening with the biosynthesis of starch in this variety of potato. The Amflora potato is solely grown for the purposes of enhancing its industrial application. Although the Amflora potato is not fit for human consumption, the presence of the potato itself or any of its derived products in the food chain cannot be excluded, it should be considerate adventitious or technically unavoidable and can be accepted in a proportion no higher than 0.9%. To achieve the goal of our work we analysed forty-five potato-derived products to evaluate transgenic potato presence by real time polymerase chain reaction, obtaining negative results. In order to verify the correct application of the law and to assure the quality for the consumer, it is necessary to continue GM monitoring to verify the adventitious presence itself in food.

Introduction

Amflora (EH92-527-1) is a genetically modified (GM) potato variety, *Solanum tuberosum* L. of the chemical company BASF (Ludwigshafen, Germany). The potato has a modified starch composition. In the conventional potato starch is composed of two main parts amylose and amylopectin, 20 and 80% respectively. While amylopectin is the required starch component for industrial purposes due to its thickening properties, amylose is the unwanted starch component due to its gelling properties that result in the dissolved potato starch being unstable. For this reason, the two components must be separated. Separating amylopectin and amylose in potato starch requires energy and water consumption which makes it uneconomical. Although potatoes by their nature produce a mixture of amylose and amylopectin, Amflora was genetically engineered to produce only the amylopectin component of starch. Amflora was developed by silencing the expression of the starch synthase protein (GBSS), using antisense strategy to eliminate the expression of amylose. A gene conferring kanamycin resistance (*nptII*) was used as a selectable marker. Since Amflora potato is not fit for human consumption, it is solely grown to improve the industrial applications of the potato (paper industry, textile industry, in adhesives and in construction materials) (Abdallah, 2010).

The placing of the GM potato EH92-527-1 (BPS-25271-9) on the market for cultivation and industrial uses has been approved by the Commission Decision 2010/135/EU, in accordance with Directive 2001/18/EC of the European Parliament and of the Council (European Commission, 2010a); whereas the Commission Decision 2010/136/EU, has authorised the placing on the market of feed produced from GM potato EH92-527-1 (BPS-25271-9) and the adventitious and technically unavoidable presence of the potato in food and other feed products, under Regulation (EC) No 1829/2003 of the European Parliament and of the Council (Commission Decision, 2010b).

The aim of this study was to screen commercial processed containing potato derived products from both nation and international markets, in order to monitor and verify the adventitious presence of GM Amflora.

Materials and Methods

Forty-five samples of potato-derived products from different markets were investigated (Table 1). DNA extraction from frozen and dried potato was carried out in accordance with CTAB method validated by European Union Reference Laboratory for GM food and feed. The DNA of each sample was examined to verify potato-DNA by Real Time PCR by amplification of *UDP-glucose pyrophosphorylase* (*UGPase*) gene (Savini *et al*., 2006, 2010). The potential presence of GM potato in food matrices was detected by PCR screening for the *nos* terminator (T-nos) DNA sequence of nopaline synthase from *Agrobacterium tumefaciens,* according to real-time PCR method for detection of T-nos (Permingeat *et al.*, 2002).

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Results

The amplification plot showed the presence of an 88bp fragment of the *UGPase* gene from *Solanum tuberosum* in all samples examined (Figure 1a). The PCR screening of *nos* terminator (T-nos) DNA sequence, of nopaline synthase from *Agrobacterium tumefaciens,* confirmed the total absence of Amflora potato in food matrices investigated, as showed in Figure 1b and Table 2.

Discussion and Conclusions

In order to verify the correct application of the law, it is required to constantly monitoring food matrices to safeguard the consumers. The European Regulations set the labelling requirements for all the GM organism-containing products (food and feed), with a tolerance threshold established at 0.9% for authorised GM organisms and at 0.5% for GM organisms under authorisation procedure (Regulation EC N.1829/2003; European Commission, 2003). Amflora is been marketed for industrial use but not authorised for human consumption, thus its presence can only be accepted with a tolerance threshold below 0.9%, as an adventitious presence. The method used for DNA-extraction of starch products from food

Table 1. Potato-derived products investigated and their country of origin.

Potato-derived products	Number of samples	Country of origin (manufactured or produced)
Raw potato	5	Italy
Potato flour	5	Italy/Germany
Mashed potato (frozen and dried)	5	Italy/Germany/France
Crisps	5	Italy/Germany
Frozen fries chips	5	Italy/Germany/Canada
Frozen raw potatoes	5	Italy/Germany/Canada
Bread-potato	5	Italy
Homemade potato-sweet	5	Italy
Homemade potato-pasta	5	Italy

matrices is particularly suitable to provide a very good performance as confirmed by *UGPase* endogenous gene amplification, for all sample analysed (Figure 1a and Table 2). An high-quality potato-DNA is essential in order to achieve the subsequently real time PCR assays to verify the potential presence of GM material. Results are able to confirm the total absence of Amflora for the samples analysed so far. It is necessary to continue GM monitoring so as to assure consumers about the absence of Amflora in both local and imported food products.

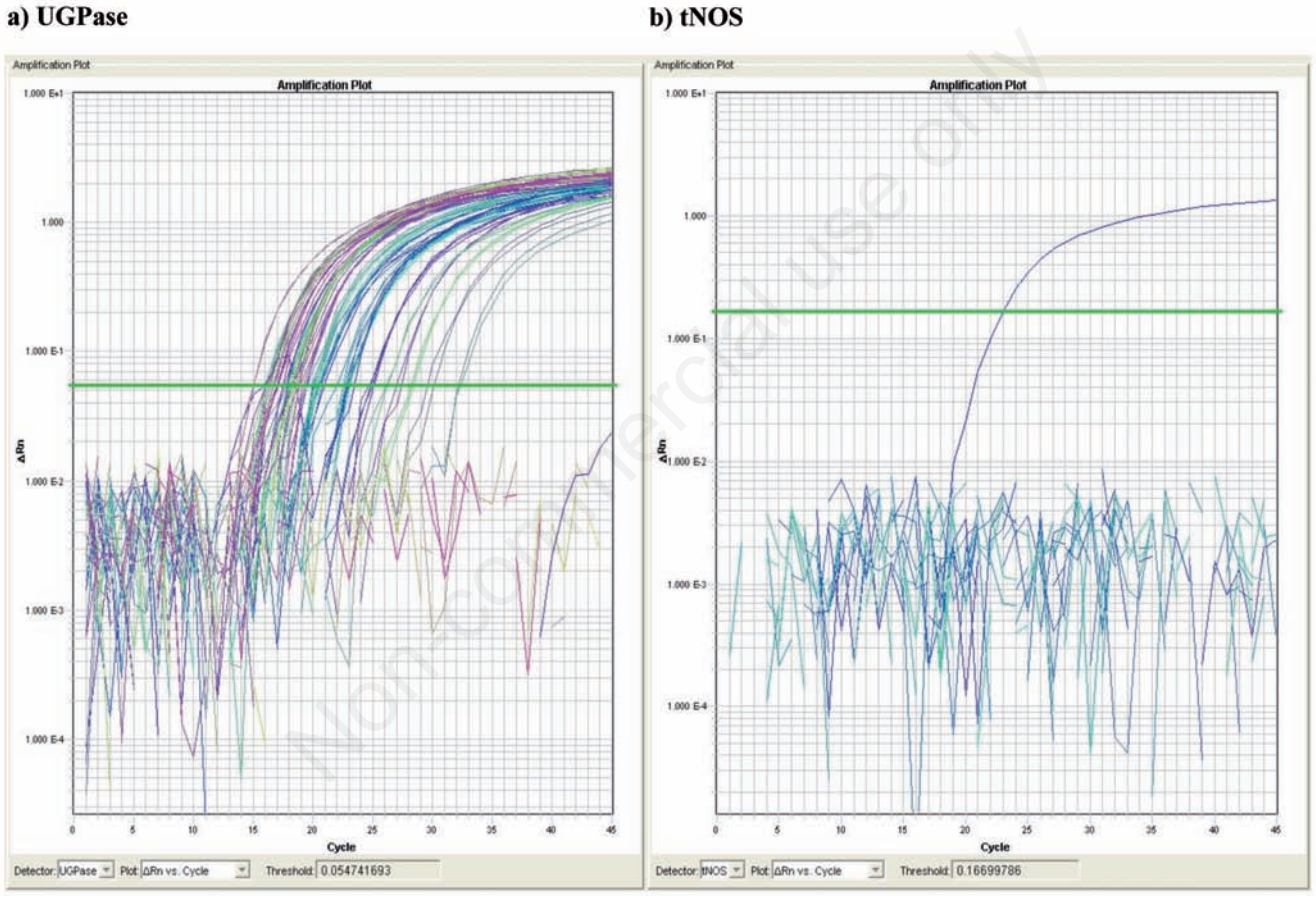

Figure 1. Amplification plot of *UDP-glucose pyrophosphorylase* gene (a) and nos terminator DNA sequence (b) in all samples examined.

Table 2. Results obtained by real time polymerase chain reaction by amplification of *UDP-glucose pyrophosphorylase* gene and nos terminator DNA sequence in all samples investigated.

Potato-derived products	Number of investigated samples	*UGPase* number of positive samples	*nos* terminator (T-nos) DNA sequence
Raw potato	5	5	Absence
Potato flour	5	5	Absence
Mashed potato (frozen and dried)	5	5	Absence
Crisps	5	5	Absence
Frozen fries chips	5	5	Absence
Frozen raw potatoes	5	5	Absence
Bread-potato	5	5	Absence
Homemade potato-sweet	5	5	Absence
Homemade potato-pasta	5	5	Absence

UGPase, UDP-glucose pyrophosphorylase.

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