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Surveying genetically modified maize in foods marketed in Algeria

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ABSTRACT

Despite the prohibition of the importation, production, distribution, marketing and use of genetically modified (GM) plants in Algeria, no legislation regarding their use in food and feed production has been established. The present work describes, for the first time, a full-stage study to monitor genetically modified organisms (GMO) in Algeria, based on a comprehensive survey of maize-derived foods, providing screening, event-specific identification and quantitative data targeting 11 maize events (Bt176, Bt11, MON810, GA21, NK603, MON863, TC1507, MIR604, DAS59122, 3272 and DAS40278). The results show that, out of 91 maize-derived samples positive for an endogenous maize gene, 20% contained at least one screening GM element. Six events were identified in 16 samples, being MON810, NK603 and TC1507 the most frequent (16%, 15% and 14% of the samples, respectively), followed by GA21, Bt11 and DAS59122 (7.6%, 6.6% and 2.2%, respectively). Interestingly, out of those samples, 14 had 3–5 GM events, while only 2 had one or 2 events. The quantitative real-time PCR results show very high levels of GM maize events in all samples resultant from the multiple-event accounting (34.9–222.7%), suggesting the presence of stacked events, together with single-trait ones. These findings highlight the need for specific labelling legislation regarding the GMO presence in food and the verification of its compliance.

1. Introduction

The application of genetic engineering technology to food crops has achieved remarkable success by introducing characteristics of interest, such as herbicide tolerance, insect resistance, and enhanced shelf life or modified nutritional composition. Since the first genetically modified organism (GMO) approval in 1996, the number of genetically modified (GM) crops introduced to the market has been dramatically increasing, as well as the number of countries involved in their production/commercialisation, the diversity of novel traits and the global trade. So far, 31 different GM crops, accounting 519 transgenic events, have been authorised for food and feed production in 44 countries (ISAAA, 2019). The cultivation area of GM crops reached 189.8 million hectares by 2017, from which, soybean and maize accounted for 50% and 30% of the total area, respectively (James, 2017). Maize, one of the most used staple food and feed ingredients, is the second most cultivated GM crop with the highest number of approved events (238) (ISAAA, 2019).

Despite the benefits claimed by their producers, the introduction of GMO in the food chain has generated an intense public and scientific debate. Concerns about potential risks on human health, environment and biodiversity, as well as the need to provide information to the consumers, have driven international regulatory bodies to deal with the biosafety measures of GMO, introducing food-labelling regulations for consumer's protection. For instance, the European Union (EU) has established specific regulation regarding GMO approval, requiring the compulsory labelling for all food products consisting of, produced or containing GMO above 0.9% (Regulation (EC) No 1829/2003). In Algeria, the discussion around GMO regulation and other related issues appeared with the adoption of the Cartagena protocol on biosafety. The country has ratified the protocol and promulgated a regulation, prohibiting importation, production, distribution, marketing and use of genetic GM plant materials, except for research purposes (Ministerial Order, 2001). However, no specific regulation has been established to control the presence or use of GMO in food, as well as to regulate labelling.

The need to comply with the legislation requirements has generated interest in analytical methods for the reliable detection of GMO in food. Therefore, several approaches have been developed based on the identification of the introduced DNA or the encoded novel protein(s). Due to the high stability of DNA molecules compared to proteins and their presence in most biological tissues, DNA-based methods have been the premium choice for the analysis of GMO in foods (Mafra, 2011;

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