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Short Communication

Declaration of Fumonisin as the Main Dangerous Mycotoxin Produced by *Fusarium* Species on Maize in Iran

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Abstract

Our study showed *Fusarium* spp. can be the most important fungal pathogen of maize causing severe yield losses and producing fumonisins that concern human and animal damages. Actually, other mycotoxins such as aflatoxin contamination have become regular in maize but the appearance of fumonisins was more frequent. However, the fluctuation between years and regions can affect the severity of the infection and then fumonisin production level. This mycotoxin was defined as fumonisin B1, fumonisin B2 and fumonisin B3 with diverse actions. The level of production, concentrations, and damages of fumonisins were found in different locations of maize fields in Iran. However, the fumonisin contents of the isolated samples were more diverse than in other locations. Toxin composition and maximum values differ significantly throughout the climate conditions and maize cultivars. The resistance cultivar of maize against the *Fusarium* pathogen can be helpful in controlling fumonisin production on the field effectively.

More Information

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Introduction

Fumonisins as the main mycotoxins are mainly produced by the *Fusarium verticillioides* which are found worldwide as contaminants of maize. However, *F. verticillioides* causes infection in some locations of Iran under diverse field conditions. Our study showed that Fumonisin mycotoxin was assessed for all the maize cultivars in different areas in Iran. However, the production of fumonisin, trichothecenes, deoxynivalenol, and zearalenone in maize is attributed mainly to diverse *Fusarium* species including *F. verticillioides*, *F. proliferatum*, *F. solani*, *F. fujikuroi*, *F. graminearum*, *F. crookwellense*, *F. sporotrichioides*, *F. culmorum*, trichothecenes), and *F. equiseti* [1,2]. As reported (Table 1), *F. verticillioides* and *F. proliferatum* species produced FB_1, with values of 505 and 216 µg/g, but *F. verticillioides* strains produced FB_1 levels above 150 and up to 2232 µg/g, except two strains (about 80 µg/g). On the other hand, FB_1 production of *F. proliferatum* strains was more changeable with values ranging from 1 to 1860 µg/g and a mean of 216 µg/g. It was found that 17 *F. proliferatum* strains on 26 (65%) also produced FB_2 and 11 strains (42%) produced FB_3, with mean values of 30 and 3 µg/g. In particular, FB_2 production was about 25 µg/g, except for one strain that produced 466 µg/g. Entire FBs produced by *F. proliferatum* ranged between 1 µg/g to 2335 µg/g, with a mean value of 238 µg/g. Also, *F. verticillioides* and *F. proliferatum*, the only *F. nygamai* strain that was also analysed for FB production, can produce FB_1 (38 µg/g). The result of the experimental work can be seen in the Table 1.

Table 1: Fumonisin mycotoxin, presented in µg/g, of *F. verticillioides* and *F. proliferatum* species from Iranian maize kernels. For each mycotoxin mean of production with standard error (SE) is reported.

Fumonisin Production Species	*F. verticillioides*	*F. proliferatum*			
	FB_1 *	FB_1	FB_2	FB_3	Total FBs
N. positive species/total	67/67	26/26	17/26	11/26	26/26
Range (µg/g)	79–2232	1–1860	0–466	0–11	1–2335
Mean ± SE (µg/g)	505 ± 38	216 ± 69	30 ± 18	3 ± 1	238 ± 442

Our research showed agricultural productions such as maize contaminated by mycotoxins mainly in the field. However, processing and storage of feed products with moisture content and environmental temperature are the key determinants of this mycotoxin production [3,4]. Fungal growth in feeds is undesirable because it produces toxins that damage animal health and productivity [5]. Adverse effects of mycotoxins-contaminated livestock feed include reduced feed intake, feed refusal, poor feed conversion, diminished body weight gain, and many other diseases [6]. Moreover, mycotoxins could potentially impose large costs on the economy by reduction of agricultural production [7].

Actually, it should be appropriate to understand the sources of mycotoxins in animal feeds and human foods and find diverse ways to prevent or control mycotoxins in animals and humans. This review is intended to explore and provide information about the most prevalent mycotoxins in animal feeds. The review also highlights the origin of mycotoxins in feeds, and the possible risks they pose to feeds and livestock production in general. Generally, mycotoxins preventive methods and mycotoxins risk management methods both before and after harvesting animal feeds are well deliberated.

Our study showed *F. verticillioides* species was considered the main culprit for fumonisin production in maize kernels in the country. Meanwhile, the population of *F. verticillioides* needs to be studied at a molecular level, to know the genetic mechanism involved in fumonisin production. Furthermore, the extended occurrence of maize in Iran of *F. proliferatum* species may produce in vitro all three more common and toxic fumonisin, which can be a very important contributor to the final contamination of maize in the field. Really, fumonisins are associated with a variety of adverse health effects in livestock and experimental animals.

Generally, fumonisin as a main dangerous mycotoxin causes adverse health effects in humans, and available studies demonstrate inconclusive associations between fumonisins and human cancer. However, toxicological information on the adverse health effects of fumonisins in animals can be conversant. Of course, the epidemiological information of the corporation between fumonisins and corn products should be understood. The role of fumonisins in proceeding corn products for animal consumption varies depending on the milling and other processes that raw corn endure. Actually, cattle, sheep, and poultry are considerably less susceptible to fumonisins than are horses or swine for example cattle and sheep tolerate fumonisin concentrations about 100 ppm.

Although dietary concentrations of about 150 ppm - 200 ppm can cause appetence, weight loss, and mild liver damage, poultry are affected by concentrations about > 200 ppm – 400 ppm and may cause lack of interest, weight loss, and so others [8]. On the other hand biological control methods can be employed to minimize the contamination of fumonisin produced by *F. verticillioides* [9]. We also used *Bacillus velezensis* UTB96 for the reduction of zearalenone produced by *Fusarium graminearum* isolated on wheat in Iran [10]. The result showed we can use microorganisms such as Bacterial species for the detoxification of mycotoxins in agricultural products.

Nevertheless, we believe the *F. proliferatum* incidence in Iranian maize compared to previous reports and confirmed an extended concern for the potential contamination of maize by different mycotoxins special fumonisins in diverse parts of Iran. In addition, the occurrence of the *Fusarium fujikuroi* species which are trichothecene and zearalenone producers has been recorded already in Iran. In general, the distribution of diverse *Fusarium* species highlights the possible increased risk for human and animal health in the whole country. Commonly, the control of mycotoxins is for the purpose of public health importance and economic improvement in the country. Therefore, a number of strategies for the reduction and control of mycotoxins have been considered in different areas of the world.

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