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ORIGINAL ARTICLE

Report on Mycobial and Mycotoxin Contamination in Yam (*Dioscorea alata* L.) Samples

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ABSTRACT

Yam is a carbohydrate rich underground vegetable and its tubers are not only used as staple food for tribals but also serve as common vegetable and almost throughout the country. In addition, the tubers are reported to be antihelminthic and useful in leprosy, piles and gonorrhoea. It is evident from above study that mycotoxin contamination is not only a storage problem but also a field problem. However, their percentage contamination was considerably low when compared to storage. So, there is an urgent need to develop effective control measure to check mycotoxin contamination and subsequent health hazards.

Key words: *Mycobial and Mycotoxin Contamination, Yam, carbohydrate*

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INTRODUCTION

The problem of moulds and mycotoxin contamination of various agricultural commodities under post-harvest as well as pre-harvest condition has become most significant due to health hazards posed by them[1-3]. Yam is a carbohydrate rich underground vegetable and its tubers are not only used as staple food for tribals but also serve as common vegetable and almost throughout the country. In addition, the tubers are reported to be antihelminthic and useful in leprosy, piles and gonorrhoea[4]. Underground vegetables have high risk of mycotoxin contamination even under field condition because they remain in contact with abundant and diverse mycoflora of soil. Some of the underground vegetables like garlic, sweet potato and potato have been reported to be contaminated with mycotoxins[5-6]. Though, mycoflora and deterioration of yam have been studied by various investigators, no attention has been paid to mycotoxin contamination in this widely used vegetable[7]. Therefore, the present investigation has especially been undertaken not only to study the the various fungi associated with the tubers but also to evaluate extent of mycotoxin contamination in field and storage conditions.

MATERIAL AND METHODS

The samples were obtained directly from the fields at the time of harvesting, farmer's storage and the local markets of different localities of Agra region. These samples were assayed for the association of moulds following dilution plate technique[8]. The experiment was repeated thrice and the average population of individual fungi per tuber and per cent abundance was calculated.

Further, the samples were analysed for the presence of aflatoxins, ochratoxin A, zearalenone and sterigmatocystin by TLC using multimycotoxin detection method as

suggested by Stoloff et al.[9] For the confirmation of aflatoxins, orchratoxin A, zearalenone and sterigmatocystin, the methods of Stack and Pahand10, Davis et al.[11], Scott et al.[12] and Stack and Rodricks[13], repectively were followed.

Table 1: Mycoflora associated with yam

Name of fungi	Field Samples		Stored Samples	
	AP/t*	PA**	AP/t	PA
Alternaria alternata	4.4	2.09	-	-
Acremonium indicum	6.1	2.89	4.8	1.69
Aspergillus flavus	18.5	8.79	43.7	15.39
A. fumigatus	7.2	3.42	18.2	6.41
A. nidulans	-	-	6.8	2.39
A. niger	16.7	7.93	19.4	6.83
A. niveus	-	-	10.1	3.55
A. versicolor	8.3	3.94	10.7	3.76
Botryodiplodia theobromae	24.2	11.59	21.3	5.50
Cephalosporium acremonium	-	-	5.4	1.90
Chaetomium globosum	4.2	1.99	-	-
Cladosporium herbarum	5.3	2.51	-	-
Curvularia lunata	6.2	2.94	7.2	2.53
Drechslera tetramera	3.7	1.75	-	-
Fusarium moniliforme	37.6	17.87	34.5	12.15
F. oxysporum	-	-	14.1	4.96
F. semitectum	14.3	6.79	12.2	4.29
F. solani	-	-	20.7	7.29
Mucor hiemalis	4.1	1.94	9.2	3.24
Penicillium citrinum	7.3	3.46	-	-
P. funiculosum	8.5	4.03	4.8	1.69
P. nigricans	-	-	5.9	2.07
P. repens	-	-	3.8	1.33
P.verrucosum	-	-	12.1	4.24
Phoma herbarum	3.3	1.56	-	-
Rhizoctonia solani	7.1	3.37	-	-
Rhizopus stolonifer	8.8	4.18	8.1	2.85
Sicaria graseola	-	-	4.6	1.62
Trichoderma viride	8.8	4.18	6.3	2.21
Trichothecium roseum	5.6	2.66	-	-
Total population/tuber	210.4	-	283.9	-

*Average population/tuber; ** Percentage abundance.

Table 2: Natural incedence of mycotoxins in yam

Samples	Samples analysed	Samples contaminated	Percentage contamination	Specific mycotoxin detected		
				Mycotoxin	No. of +Ve samples	Concentration of mycotoxin (µg/kg)
Field	42	4	9.52	Aflatoxin B1	1	140
				Aflatoxin G1	1	120
				Zearelenone	4	260-480
Storage	78	21	26.92	Aflatoxin B1	19	10-1220
				Aflatoxin G1	12	50-630
				Ochratoxin A	3	260-720
				Sterigmatocystin	2	290-450
				Zearelenone	13	200-840

RESULTS AND DISCUSSION

Table 1 reveals that altogether 30 fungal species were associated with 120 samples of yam. Out of these, Acremonium indicum, Aspergillus flavus, A. fumigatus, A. niger, A. Versicolor, Botryodiplodia theobromae, Curvularia lunata. Fusarium moniliforme, F. semitectum, Mucor hiemalis, Penicillium funiculosum, Rhizopus stolonifer and Trichoderma viride were common to both field and stored samples. Further, Alternaria alternata, Cladosporium herbarum, Chaetomium globosum, Drechslera tetramera, Penicillum itrinum, Phoma herbarum, Rhizoctonia solani and Trichothecium roseum were found only in the samples collected from field, while Aspergillus nidulans, A. niveus, Cephalosporium acremonium, Fusarium oxysporum, F. Solani, Penicillium nigricans, P. repens, P.verrucosum and Spicaria graseola were recorded only in stored samples. The total population of fungi was higher in the stored samples (283.9 fungi/tuber) than in the field samples (210.4 fungi/tuber). Fusarium moniliforme (17.87%) followed by Botryodiplodia theobromae (11.59%), Aspergillus flavus (8.79%) and A. niger (7.93%) were most abundant species in field samples, while A. flavus (15.39%) followed by F. moniliforme (12.15%), Botryodiplodia theobromae (7.50%) and F. solani (7.29%) were dominant species in stored samples. Agarwal and Gupta14 and Sharma and chatterjee8 have also recorded varying number of fungi on tubers of yam collected from Agra and Darjeeling, respectively.

Out of 42 field samples analysed for presence of mycotoxins, 9.42% samples were found to be contaminated with mycotoxins. Among them one sample showed the presence of aflatoxin B1(140g/kg), G1 (120 g/kg) and zearalenone (320 g/kg). Further only zearalenone was recorded in the range of 260-480 g/kg in 3 more samples. The assay of 78 stored samples revealed the presence of mycotoxins in 21 contaminated samples, aflatoxin B1(10-1220 g/kg) was noted in 13 samples, ochratoxin A (60-720 g/kg) was found only in 3 samples and stergmatocystin (290-450 g/kg) could be detected in 2 samples only (Table 2). It is evident from above study that mycotoxin contamination is not only a storage problem but also a field problem. However, their percentage contamination was considerably low when compared to storage. So, there is an urgent need to develop effective control measure to check mycotoxin contamination and subsequent health hazards.

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