Asian Journal of Agriculture & Life Sciences Vol. 3(3), July 2018: 5-7

Website: www.crsdindia.com/ajals.html e-ISSN: 2455-6149

ORIGINAL ARTICLE

Natural Contamination of Mycotoxins of *Penicillium* and *Fusarium* in Some Crude Herbal Drugs

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Received: 27th Feb. 2018, Revised: 25th March 2018, Accepted: 8th April 2018

ABSTRACT

Sixty samples of stored crude herbal drugs comprising of 10 samples each of safed musli (*Chlorophytum borivilianum*), satavar (*Asparagus racemosus*), sarpgandha (*Rauvolfia serpentina*), ashvagandha (*Withania somnifera*), mullathi (*Glycyrhiza glabara*) and anantmul (*Hemidesmus indicus*) were studied for contamination of patulin, citrinin, zearalenone and fumonisin-A. Out of 60 samples, patulin was recorded in 25 samples in the range of 200-650 ppb, while citrinin was present in 17 samples in the range of 100-400 ppb. This mycotoxin was absent in samples of mullathi. Further 31 samples of these herbal drugs showed presence of zearalenone in the range of 200-700 pbb and fumonisin was recorded in 23 samples ranging from 150 to 500 ppb. Contamination of these mycotoxins in addition to aflatoxins is important in relation to human health.

Key Words: Crude herbal drugs, citrinin, patulin, zearalenone, fumonisin-A.

INTRODUCTION

Herbal medicines represent probably the first and certainly the oldest system of human health care. Almost all civilizations and cultures have employed plants in the treatment of human diseases. According to World Health Organization (WHO, 2013) herbal medicines include herbs, herbal materials, herbal preparations and finished herbal products, that contain an active ingredient of plants used for cure of human diseases. Over the last two decades, the use of herbal medicines has expanded across the globe and gained considerable popularity (Wu *et al*., 2011).

With increasing use of herbal medicines through out the world, the traders have started storing crude herbal drugs in bulk. The traditional methods of collection, transportation and storage coupled with humid climatic condition make them victim to the fungal infestation (Roy, 2003). During storage, the fungal organisms thrive on drug plants by utilizing various components including the active ingredients. Simultaneously, some fungi elaborate toxic metabolites called mycotoxins, which decrease the medicinal value of the crude herbal drug. Garg (2017) recorded presence of 33 fungal species in samples of crude herbal drugs collected from various places of Agra region. Out of these species of *Aspergillus, Penicillium* and *Fusarium* were more frequent and abundant. Interestingly, strains of these fungi produce mycotoxins, which pose problem of health hazards in men and domestic animals. In our country aflatoxins have been recorded from many herbal drug samples but very little attention has been paid to mycotoxins of *Penicillium* and *Fusarium* which are co-dominant moulds with *Aspergillus* species. Thus, attempt has been made in present paper to study contamination of mycotoxins of *Penicillium* and *Fusarium* species associated with some crude herbal drugs.

MATERIALS AND METHODS

Sixty samples of stored crude herbal drugs comprising of 10 samples each of safed musli (*Chlorophytum borivilianum*), satavar (*Asparagus racemosus*), sarpgandha (*Rauvolfia serpentina*), ashvagandha (*Withania somnifera*), mullathi (*Glycyrrhiza glabara*) and anantmul (*Hemidesmus indicus*) collected from rural traders of Agra were subjected to screening for association of moulds following Graves and Hesseltine (1966). Simultaneously, these samples were extracted for presence of patulin, citrinin, zearalenone and fumonisin-A following method outlined by Roberts and Patterson (1975) using thin layer chromatography (TLC) and spectrophotometery. The results so obtained are presented in Table 1.

Table 1: Natural Contamination of Mycotoxins of *Penicillium* and *Fusarium* species in Some Crude Herbal Drugs

S.No.	Name of drug plant	No. of samples analysed	No. of samples +v for mycotoxins				Range of Mycotoxin Conc. (in ppb)			
			PAT	CIT	ZEA	FUM	PAT	CIT	ZEA	FUM
1.	Safed musli (*Chlorophytum borivilianum*)	10	5	4	6	4	300-450	200-350	350-700	300-500
2.	Satavar (*Asparagus racemosus*)	10	4	4	5	5	350-650	150-250	300-650	250-450
3.	Ashvagandha (*Withania somnifera*)	10	6	5	6	5	250-400	200-400	250-450	300-550
4.	Sarpgandha (*Rauvolfia serpentina*)	10	4	3	5	5	300-500	150-350	300-450	250-400
5.	Mullathi (Glycyrrhiza glabara)	10	3	–	4	2	200-300	–	250-400	200-350
6.	Anantmul (*Hemidesmus indices*)	10	3	1	5	2	250-350	100-250	200-350	150-250

PAT = Patulin; CIT = Citrinin; ZEA = Zearalenone; FUM = Fumonisin-A

RESULTS AND DISCUSSION

The screening of 60 samples of herbal drugs comprising 10 samples each of safed musli, satavar, sarpgandha, ashvagandha, mullathi and anantmul for the association of moulds revealed the presence of 33 fungal species (Garg, 2017). These fungi included 10 species of *Aspergillus*, 4 species each of *Fusarium* and *Penicillium*, 2 species each of *Rhizopus* and *Mucor* and 1 species each of *Aeremonium, Actinomucor, Alternaria, Cephalosporium, Cladosporium, Chaetomium, Cunninghamella, Curvularia, Rhizoctonia, Trichothecium* and *Verticillium*. The most frequent and dominant mould was *Aspergillus flavus*, followed by species of *Fusarium* and *Penicillium*. Garg (2017) reported presence of aflatoxin B_1, B_2 and G_1 in 80% samples of safed musli and satavar, 70% samples of sarpgandha, 60% samples of ashvagandha, 50% samples of anantmul and 40% samples of mullathi.

In present study, nearly 50% samples of these herbal drugs were found to be naturally contaminated with patulin, citrinin, zearalenone and fumonisin-A in variable quantity ranging from 100-700 ppb. Interestingly, citrinin was found in lowest concentration (100-400 ppb) in all herbal drugs except samples of mullathi. The mycotoxin patulin was found in all crude herbal drugs in the range of 200-450 ppb. Among fusarial mycotoxins, zearalenone was more frequent than fumonisin-A. The concentration of zearalenone ranged from 200-700 ppb while fumonisin was recorded in the range of 150-500 ppb.

In general samples of ashvagandha were more contaminated than others. Samples of safed musli showed little less contamination followed by sample of satavar. Interestingly, samples of mullathi revealed minimum fungal infestation and mycotoxin contamination. Anantmul samples showed little more contamination of these mycotoxins than mullathi. It is also important to mention here that, these mycotoxins were present in addition to aflatoxin B_1, B_2 and G_1 in crude herbal drugs. Neeta Rani and Singh (1996) reported aflatoxin B1, ochratoxin, sterigmatocystin, zearalenone and patulin in some pulse products consumed by human beings likewise, Roy (2003) recorded aflatoxin B_1, B_2, G_1 and G_2, ochratoxin-A, citrinin and zearalenone in some skin and liver curative crude herbal drugs. It is well established that mycotoxin contaminated herbal drugs may cause health complications instead of curing diseases. Thus, it is worthwhile to undertake an intensive sureillance upon this problem.

ACKNOWLEDGEMENT

Author is highly thankful to C.S.T., U.P. for financial assistance. Sincere thanks are also due to the Principal, Agra College and the Head, Botany Department, Agra College, Agra for providing laboratory facilities and encouragement.

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