FUNGAL FLORA OF DRIED FIGS: THE INCIDENCE OF AFLATOXIGENIC MOULDS

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Although the occurence of aflatoxin in figs and the potential supporting capacity of this produce for aflatoxin production have been reported in 1970's until recent years figs had not been recognised as a high-risk commodity from the standpoint of aflatoxin. The objective of this study was to examine mould flora of dried figs with special reference to aflatoxin-producing strains of **Aspergillus flavus/parasiticus.**

A total of 64 storehouse samples consisting industrial and table type dried figs (1986 crop) have been examined. The mean mould counts for 64 samples of dried figs ranged from <10 colonies/g to 6050 colonies/g. The mould flora which consisted 10 species namely **Aspergillus niger, A.parasiticus, A.flavus, A.terreus, Rhizopus stolonifer, Mucor racemosus, Alternaria tenuissima, Fusarium solani, Penicillium purpurogenum** and **P.crysogenum** were dominated by Aspergillus spp. The most frequently encountered mould species was found to be **A.niger** (92 %), followed by **A.parasiticus** (12 %), **R.stolonifer** (9 %), **M.racemosus** (9 %) and **A.flavus** (5 %). Eleven samples contained **A.parasiticus** (8 samples) or **A.flavus** (3 samples) and all of isolates produced aflatoxins (B_1, B_2, G_1,G_2) in vitro.

Introduction

Aflatoxins which are metabolites of the moulds **Aspergillus flavus** and **Aspergillus parasiticus** are considered to be one of the most dangerous contaminants in foods and feeds and at present many countries have introduced strict legislations to control the sale or importation of aflatoxin contaminated commodities (Denizel and Köşker, 1972; Stolof, 1976; Jewers, 1982; Anon, 1982; Bullerman et. al. 1984; Sanchis et. al., 1986; Egmond, 1987).

Following the first reporty by the mid 1970's that dried figs may be contaminated with aflatoxin, it has been shown that ripe figs at orchards are rather vulnerable to fungal infection and aflatoxin occurence (Buchanan et. al., 1975). Additionally dried figs along with other carbohydrate-rich fruits such as pineapples and apricots are reported to be good substrates for aflatoxin production (Morton et. al. 1979). Although aflatoxin incidence in dried figs are reported to be low, reports concerning aflatoxin contaminated dried figs have arisen in recent years (Steiner et. al., 1988).

This paper presents an examination of the mould flora of dried figs obtained from different storehouses and the subsequent laboratory analysis of the aflatoxigenic potential of some fungal isolates.

Materials and methods

Fig samples

A total of 64 dried fig samples were collected from the different storage houses at fig growing area of Ege Region. The average weight of the field samples was 2.5 kg.

Enumeration of moulds

150 g sample units (5-6 figs) were cut and crushed into paste in sterile porcelain mortar; 25 g of the paste was suspended in 225 ml sterile peptone water, and moulds enumerated using duplicate pouring plates which incubated at 25°C for 7 days. Media used were Potato Dextrose Agar (PDA, Oxoid, pH: 5.6), acidified PDA (APDA, pH: 3.5) and Czapex Dox Agar (Oxoid, pH: 6.8) containing 20 % saccharose.

Identification of moulds and detection of aflatoxin-producing strains of A.flavus/A.parasiticus

Identification of isolates which subcultured on Malt Extract Agar (Oxoid), Potato Dextrose Agar (Oxoid) and Czapex Dox Agar (Oxoid) was based on colony colour and gross morphology of spore heads (Raper and Thom,1949; Raper and Fennell, 1965; Smith, 1971). Isolates which were identified as **A.flavus/A.parasiticus** were examined for the production of aflatoxin using the aflatoxin production medium (APA) of Hara et. al. (1974), modified by omitting the corn steep liquor. For the extractions of aflatoxins from fluorescent medium the procedure of Hara et. al. (1974) was followed except that thin layer chromatograms were developed in chloroform-acetone (9:1, v/v) and viewed under UV-illumination at 366 nm.

Results

The mould counts for 64 storehouse samples of dried figs are shown in Table I. As it can be seen from the table, mould counts were less than 10.000/g, ranging from <10/g to 6050/g. **Aspergillus spp.** were the main components of the mould counts (Table II) and the relative frequency of **A.niger** isolates was high (92 %). It was followed by **A.parasiticus** (12 %), **Rhizopus stolonifer** (9 %), **Mucor racemosus** (9 %), and **A.flavus** (5 %). Three samples contained **A.flavus** whereas **A.parasiticus** was isolated from 8 samples. Approximately 17 % of samples were found to be contamined with the mould strains of **A.flavus** and **A.parasiticus.** For both species two different strains were identified. All strains produce fluorescent zones on APA, giving identical spots of aflatoxins B_1, B_2, G_1 and G_2 on thin-layer chromatograms.

Table I. Mould count of dried figs (on OPDA, at 25 C for 7 days)

Mould per gram	Number of samples
<10	3
10 - 50	17
51 - 100	13
101 - 200	11
201 - 400	6
401 - 500	4
501 - 700	2
701 - 800	2
801 - 1000	1
>1000	5
Range of values : <10 - 6050	

Table II. The mould flora of dried figs

Mould spp.	Number of samples contaminated
Aspergillus	
niger	59 (92)[a]
parasiticus	8 (12)
flavus	3 (5)
terreus	3 (5)
Rhizopus stolonifer	6 (9)
Mucor racemosus	6 (9)
Alternaria teneuissima	2 (3)
Fusarium solani	1 (2)
Penicillium	
purpurogenum	1 (2)
crysogenum	1 (2)

a : Numbers in paranthesis indicate the percentage of positive samples.

Discussion and conclusions

The mould count of samples fell within the range found in a range of dried figs and paste by other workers (Aşkın et. al.,1977). The mould flora was found to be dominated by **A.niger** as in the studies of Aşkın and her colleagues. Although there is no recommended microbiological limit for the mould count in dried figs, fungal load is not the only criterion which determines the product safety from the aflatoxin standpoint, since we know that it is the physical and climatic environment that determines which species of fungus may grow and hence mycotoxin produced. This investigation as well as others (Aşkın et.al., 1977; Steiner et. al., 1988) showed that dried figs may become naturally infected by **A.flavus** and **A.parasiticus** and that some strains have the potential to grow on dried figs and produce significant amounts of aflatoxins. Therefore the need for the improvement of drying techniques is obvious, since present conditions seem to be favorable for aflatoxin production in infected fruit.

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LA MICROFLORE DE LA FIGUE SECHE : IMPORTANCE DES MOISISSURES PRODUCTRICES D'AFLATOXINES

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RESUME

Bien que la présence d'aflatoxines dans les figues, ainsi que la possibilité que ce produit puisse servir de support potentiel à la production d'aflatoxines aient été rapportées dans les années 70, jusqu'à ces dernières années, la figue n'avait pas été reconnue comme un support à haut risque du pur point de vue de l'aflatoxine. L'objet de cette étude était d'examiner la flore des moisissures de figues sèches, en se référant plus spécialement à des souches productrices d'aflatoxines, l'*Aspergillus flavus/parasiticus*. Un total de 64 échantillons choisis dans des magasins de stockage et consistant en figues sèches dites de type industriel ou de table (récolte 1986), a été examiné. Le contenu moyen en moisissures des 64 échantillons allait de 2,1 x 10 colonies/g à 30,3 x 10^5 colonies/g. La flore des moisissures de 10 espèces, à savoir : *Aspergillus niger, A. parasiticus, A. flavus, A. terreus, Rhizopus stolonifer, Mucor racemosus, Alternaria tenuissima, Fusarium solani, Penicillium purpurogenum et P. crysogenum* a été dominée par *Aspergillus spp.* L'espèce qu'on rencontre le plus fréquemment dans les moisissures s'est avérée être *A. niger* (92 %), suivie de *A. parasiticus* (12 %), de *R. stolonifer* (9 %), de *M. racemosus* (9 %) et de *A. flavus* (4 %). Dix échantillons contenaient *A. parasiticus* (7 échantillons) ou *A. flavus* (3 échantillons) et tous les échantillons isolés ont produit des aflatoxines (B1, B2, G1, G2) in vitro.