codex alimentarius commission

E

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

JOINT OFFICE: Viale delle Terme di Caracalla 00153 ROME Tel: 39 06 57051 www.codexalimentarius.net Email: codex@fao.org Facsimile: 39 06 5705 4593

Agenda Item 14(d) **CX/CF 07/1/20**
February 2007

JOINT FAO/WHO FOOD STANDARDS PROGRAMME
CODEX COMMITTEE ON CONTAMINANTS IN FOODS
First Session
Beijing, China, 16 - 20 April 2007

DISCUSSION PAPER ON AFLATOXIN IN DRIED FIGS

BACKGROUND

1. The Codex Committee on Food Additives and Contaminants (CCFAC), at its 38th Session, agreed to establish an electronic working group to revise the document contained in CX/FAC 06/38/40. As agreed by the Committee (see ALINORM 06/29/12, para. 211), the electronic working group led by Turkey prepared this discussion paper on aflatoxin in dried figs, which includes i)additional information and date on the occurrence of aflatoxins in dried figs; ii)description of the difficulties in trade; and iii)an outline of a code of practice for the prevention and control of aflatoxin in dried figs and a project document for starting new work on the elaboration of a Code of Practice. The electronic working group includes European Community, France, Greece, United Kingdom, United States, WHO and INC.

INTRODUCTION

2. The aflatoxins are mycotoxins that may be present in many foods, especially oil seeds, tree nuts, cereals, spices, milk and dairy products. Many of these foods are the main sources of dietary exposure to aflatoxins. Aflatoxin contamination is also an important problem in figs because the fruit formation, harvesting and drying processes for figs differ from those involving other dried fruits.

3. Aflatoxin B1, B2, G1 and G2 are mycotoxins that may be produced by three moulds of the Aspergillus species: *Aspergillus flavus, Aspergillus parasiticus* and *Aspergillus nomius*, which contaminate plants and plant products. Aflatoxin M_1 and M_2, the hydroxylated metabolites of aflatoxin B_1 and B_2, may be found in milk and milk products obtained from livestock that have ingested contaminated feed. Of the four B and G aflatoxins, B_1 is the most frequent one present in contaminated samples and aflatoxin B_2, G_1 and G_2 are generally not reported in the absence of aflatoxin B_1. Most of the toxicological data available relate to aflatoxin B_1. Dietary intake of aflatoxins arises mainly from contamination of maize, groundnuts and their products (1).

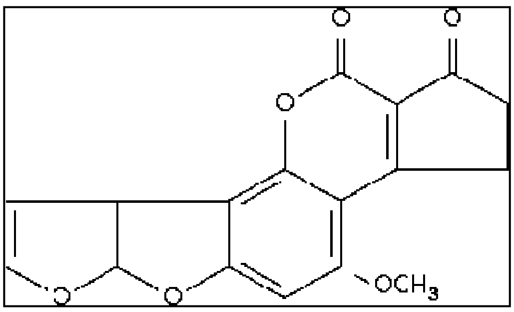

Figure 1. Chemical structure of B1

4. Figs (Ficus carica L.), one of the sacred fruits, have been available in the food supply from the beginning of human history. Figs have a high ecological adaptability and are widespread in Central Southern Asia, Southern Europe, Africa (Mediterranean coast and South Africa), America (California and Southern American Countries) and Australia. Because fresh figs are perishable resulting in difficulties associated with the use of common transportation, they have been known only where they have been grown; there was no opportunity for them to be known where they had not been grown. (4, 5).

5. The optimal average orchard temperature for the early growth phase of figs is 18-20 °C; a higher temperature (30 °C) is required during the fruit ripening and drying phase that occurs in August and September. For getting a high quality crop, the relative humidity must be around 40-50 % during the drying period. The pH value of the soil should be between 6.0 and 7.8 (4, 5).

6. For the figs which require pollination for producing the main ìsummer cropî, male flowers need to mature at the same time with the female flowers. This operation is called ìcaprificationî and the male fruits are called ìcaprifigsî (4, 5).

7. Figs differ from other fruit during the fruit formation stage and exhibit unique fruit properties. Figs have high sugar content and since they do not have a hard and protective skin, aflatoxin contamination can occur easily. Figs can become contaminated with fungi on the tree after the ripening of fruit, after shriveling, after falling from the tree onto the ground and during the drying process. Fungal contamination can occur both on the skin and inner cavity of the fruit (4, 5).

Table 1. World Production (Fresh - tonnes)

Countries	YEARS					
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
Algeria	54,326	40,864	60,694	63,266	63,000	63,000
Egypt	187,698	150,200	194,631	135,834	160,124	170,000
Greece	80,000	80,000	24,900	23,400	25,000	80,000
Iran, Islamic Rep of	78,163	71,228	81,000	89,000	90,000	90,000
Morocco	68,400	75,600	97,500	67,000	60,000	60,000
Spain	56,014	43,163	41,130	43,533	41,278	38,000
Syrian Arab Republic	44,071	40,019	43,400	43,400	43,400	43,400
Turkey	240,000	235,000	250,000	280,000	275,000	280,000
United States of America	50,712	37,195	48,260	43,999	46,085	46,500
WORLD+	1,074,073	983,904	1,038,100	993,966	1,011,480	1,075,174

(Source: www.fao.org)

Table 2. World Consumption (fresh 1000 tonnes)

Countries	YEARS				
	2000	2001	2002	2003	2004
Algeria	50,24	38,26	57,24	59,16	59,34
China	10,71	10,10	12,34	17,75	27,58
Egypt	174,52	138,32	181,19	125,01	146,97
France	26,47	29,43	27,12	28,82	32,77
Germany	25,73	25,67	26,36	25,59	29,39
Iran, Islamic Rep of	29,61	34,17	40,32	42,96	73,14
Italy	34,55	29,72	23,12	30,01	34,78
Morocco	60,52	66,56	86,06	59,02	52,14
Spain	45,00	34,43	18,37	31,00	31,56
Turkey	87,83	90,60	117,59	119,45	93,16
United States of America	53,62	37,84	59,62	56,31	48,09

(Source: www.fao.org)

Table 3. World Export (Dried - tonnes)

Countries	YEARS				
	2000	2001	2002	2003	2004
Afghanistan	1,750	1,115	1,755	2,050	2,702
China	4,885	1,992	404	1,114	1,895
Germany	1,597	968	760	1,060	1,410
Greece	4,210	5,639	2,934	3,279	2,831
Spain	2,856	2,139	5,540	3,551	3,377
Sri Lanka	660	589	651	890	1,585
Syrian Arab Republic	2,635	2,857	3,227	1,323	2,898
Turkey	43,066	39,284	35,052	42,081	49,074
United States of America	2,649	2,529	2,343	3,390	3,835
WORLD+	78,792	69,817	65,616	72,756	75,697

(Source: www.fao.org)

Table 4. World Import (Dried - tonnes)

Countries	YEARS				
	2000	2001	2002	2003	2004
China	6,186	3,398	2,501	5,407	5,081
France	7,375	8,054	7,484	8,073	9,155
Germany	9,531	8,983	8,884	8,861	9,706
India	1,816	1,926	1,703	2,310	3,239
Italy	6,089	5,322	5,992	6,248	5,795
Russian Federation					4,112
Spain	2,373	1,863	1,665	2,277	2,709
United Kingdom	2,295	1,767	1,419	2,670	2,709
United States of America	3,817	2,845	6,280	7,572	4,420
WORLD+	66,113	62,550	62,752	72,829	79,979

(Source: www.fao.org)

TOXICOLOGICAL EVALUATIONS

8. Aflatoxins were evaluated by the JECFA at its thirty-first, forty-sixth, forty-ninth and its fifty-sixth meetings (AFM1 only). At its 49th meeting in 1997, JECFA considered estimates of the carcinogenic potency of aflatoxins and the potential risks associated with their intake. At that meeting, no numerical TDI (Tolerable Daily Intake) was proposed since these compounds are genotoxic carcinogens. The potency estimates for human liver cancer resulting from exposure to AFB1 were derived from epidemiological and toxicological studies. JECFA reviewed a wide range of studies conducted with both animals and humans that provided qualitative and quantitative information on the hepatocarcinogenicity of aflatoxins. The Committee evaluated the potency of these contaminants, linked those potencies to estimates of intake, and discussed the potential impact of two hypothetical standards on peanuts (10 or 20 μg/kg) on sample populations and their overall risk. It was concluded that reducing the permitted quantity of AFB1 in peanuts from 20 μg/kg to 10 μg/kg would not result in any observable difference in rates of liver cancer (1).

9. In the evaluation at its 49th meeting, the JECFA noted that the carcinogenic potency of AFB1 is substantially higher in carriers of hepatitis B virus (about 0.3 cancers/year/100,000 persons/ng of AFB1/kg bw/day), as determined by the presence in serum of the hepatitis B virus surface antigen (HBsAg + individuals), than in HBsAg – individuals (about 0.01 cancers/year/100,000 persons/ng of AFB1/kg bw/day). The JECFA also noted that vaccination against hepatitis B virus would reduce the number of carriers of the virus, and thus reduce the potency of the AFs in vaccinated populations, leading to a reduction in the risk for liver cancer (1).

10. Aflatoxins are potent toxic, carcinogenic, mutagenic, immunosuppressive agents, produced as secondary metabolites by the fungus *Aspergillus flavus* and *Aspergillus parasiticus* on variety of food products. Among 18 different types of aflatoxins identified, major members are aflatoxin B_1, B_2, G_1 and G_2. Aflatoxin B_1 (AFB1) is normally predominant in amount in cultures as well as in food products. Pure AFB1 is pale-white to yellow crystalline, odourless solid. Aflatoxins are soluble in methanol, chloroform, acetone, and acetonitrile (2).

11. Epidemiological, clinical, and experimental studies reveal that exposure to large doses (>6000 mg) of aflatoxin may cause acute toxicity with lethal effects whereas exposure to small doses for prolonged periods is carcinogenic (Groopmann et al 1988) (3). The adverse effects of aflatoxins on animal can be categorized into two general forms.

- Acute Toxicity
- Chronic Toxicity

12. Acute toxicity is caused when large doses of aflatoxin are ingested. This is common in livestock. The principal target organ for aflatoxins is the liver. After the invasion of aflatoxins into the liver, lipids infiltrate hepatocytes and leads to necrosis or liver cell death. This is mainly because aflatoxin metabolites react negatively with different cell proteins, which leads to inhibition of carbohydrate and lipid metabolism and protein synthesis. In correlation with the decrease in liver function, there is a derangement of the blood clotting mechanism, icterus (jaundice), and a decrease in essential serum proteins synthesized by the liver. Other general signs of Aflatoxicosis are edema of the lower extremities, abdominal pain, and vomiting. The most severe case of acute poisoning of aflatoxin was reported in north-west India in 1974 where 25% of the exposed population died after ingestion of molded maize with aflatoxin levels ranging from 6250 to 15600 mg/kg (3).

13. Chronic toxicity is due to long term exposure of moderate to low aflatoxin concentrations. The symptoms include decrease in growth rate, lowered milk or egg production, and immuno-suppression. There is some observed carcinogenicity, mainly related to aflatoxin B1. Liver damage is apparent due to the yellow color that is characteristic of jaundice, and the gall bladder becomes swollen. Immuno-suppression is due to the reactivity of aflatoxins with T-cells, decrease in Vitamin K activities, and a decrease in phagocytic activity in macrophages. These immuno-suppressive effects of aflatoxins predispose the animals to many secondary infections due to other fungi, bacteria and viruses (Robens et al 1992, Mclean 1995) (3).

ANALYTICAL METHOD & SAMPLING

14. Because aflatoxins are heterogeneously distributed in a lot, analytical and sampling methods are important factors to consider when attempting to establish a maximum level for aflatoxins in dried figs. As pointed out in discussions at the 38th CCFAC meeting relating to hazelnut, almonds and pistachios, analytical methodology and sampling plans for dried figs should be discussed after CCFAC has established a maximum level for aflatoxins in dried figs.

MAIN FACTORS INVOLVED IN THE FORMATION OF AFLATOXIN IN DRIED FIGS

15. There are several factors that effect the aflatoxin formation in dried figs. One of them is fruit formation and ripening. Caprification is necessary for the formation of fig fruit. Caprifigs are important for fig varieties and are required for fruit development. Caprifigs should be healthy, free from fungi and should have plenty live pollen grains and wasps (*Blastophaga psenes* L.). During pollination of female fig fruits by fig wasps that pass their life cycle in caprifig fruits, *Fusarium, Aspergillus* spp and other fungi can be transported to the female fig fruits from the male fruits through these wasps. The fungi may cause mould formation especially during ripening, resulting in the production of aflatoxins, smut or endosepsis (internal rot) and decrease quality and yield (4).

16. Harvesting is an important stage in the production of aflatoxins in figs. Figs should be allowed to dry on the tree until they are over-ripe. After they lose water, and are partially dry and shriveled, an abscission layer forms and the fig fruits naturally fall from the trees onto the ground. The most critical aflatoxin formation period begins with ripening and continues when shriveled until fully dried. The fig fruits should be collected from the ground daily to reduce losses, caused by diseases or pests (4).

17. In the growth and production of figs, as with other fruit, the temperature and humidity of the environment during the harvesting, storage and transportation stages can greatly affect the extent to which *Aspergillus* spp. are able to invade and proliferate in the fruit resulting in the production of aflatoxins (4).

18. In order to determine the susceptibility of figs to fungal infestation and aflatoxin contamination at various stages of development, fruits of Calimyrna (syn. Sarılop) fig, the major variety for drying, were inoculated with *Aspergillus flavus*. Inoculations of figs were made at four development stages: green with eyes closed, green with eyes open, yellow and brown. The results showed that green figs were initially resistant to *A. flavus* infection but became susceptible after the figs turned yellow. The incidences were 14 and 18 % at the yellow stage and 18 and 28 % for brown figs. *A. flavus* colonies developed both on the fig exterior and in the internal cavity. At the brown stage, the development was more in the interior than on the exterior. Wounding increased toxin formation only at the green stage but was not effective at the brown stage. The amount of aflatoxin in non-wounded brown figs inoculated with *A. flavus* was found to be 17 044 ppb. It was reported that *A. flavus* spores colonized fig fruits especially at the over-ripe stage when fruits are shrivelled on the tree. (6,7)

19. The relationship of the development of a bright greenish yellow fluorescence (BGYF) by dried figs (Ficus carica) under longwave UV light, to colonization by *Aspergillus* fungi, was determined. BGYF in naturally infected figs was associated with decay by only 4 fungal species: the aflatoxin-producing species *Aspergillus flavus* (both L and S strains) and *A. parasiticus*, and the aflatoxin non-producers *A. tamarii* and *A. alliaceus*. BGYF was more likely to be visible internally (after cutting open the fig) than externally. For all 4 species associated with BGYF, some infected figs did not show BGYF. The absence of fluorescence is probably not associated with the fungal strain or isolate involved, since isolating *Aspergillus* spp. from non-fluorescent figs followed by inoculating other figs with these isolates resulted in BGYF. Many of the non-fluorescent figs had small fungal colonies (<7 mm in diameter), even though some figs with large colonies were also non-fluorescent. The additional colonization of figs by other fungi did not affect the occurrence of BGYF in figs colonized by fungi in *Aspergillus* section Flavi. Figs infected with *A. flavus* or *A. parasiticus* and showing no BGYF were occasionally contaminated with aflatoxin, while other figs showing BGYF and infected with *A. flavus* or *A. tamarii* had no aflatoxins. Although not as promising as originally hoped, BGYF may be useful to remove aflatoxin-contaminated figs for certain specific situations in California (6).

20. Fifty fluorescent fig fruits were analyzed individually and the results revealed that 32 % were free of aflatoxins and 68 % had total aflatoxins varying between 5-3828 ppb (Ozer and Derici,1998). In 2000, fig fruit samples of Sarılop cultivar taken from the orchards/drying yards 47.9 % of the samples had varying numbers of fluorescent figs and 34.2 % of the samples with fluorescent figs had no aflatoxin contamination. In 2001, 64.8 % of the samples contained fluorescent figs and 31.2 % of these samples had no detectable levels of aflatoxin (12).

21. In 2000 and 2001, a total of 148 dried fig samples were taken from various orchards and analyzed for aflatoxin. The results showed that 63.0 % of the samples had levels exceeding the limits set at 2 ppb B1 and 4 ppb total aflatoxins, on the other hand, aflatoxin contamination exceeded the limit of 10 ppb in 27.7 % of the samples (12).

22. A survey was made on Syrian food by Haydar et al. (1990) and the highest aflatoxin contamination was found in a fig sample as 11.8 ppb.

AFLATOXIN IN DRIED FIGS

23. In Turkey;

- The average value of aflatoxin B1 is 0.33, aflatoxin total 0.54, maximum aflatoxin value is 136.01 for afl B1 and 214.93 for afl total in 16868 samples in 2004.
- The average value of aflatoxin B1 is 0.63, aflatoxin total 0.77, maximum aflatoxin value is 292.22 for afl B1 and 353.23 for afl total in 16818 samples in 2005.
- The average value of aflatoxin B1 is 1.34, aflatoxin total 1.59, maximum aflatoxin value is 249.68 for afl B1 and 264.25 for afl total in 13459 samples in 2006.

These data is also expressed in the Table 4;

Table 4. Aflatoxin data

Year	LOD	≤2		2<……≤4		4<……≤8		8<……≤10		10<…..≤20		20<	
	# of analysis	# of analysis	Mean	# of analysis	Mean	# of analysis	Mean	# of analysis	Mean	# of analysis	Mean	# of analysis	Mean
Total	**17890**	**2769**	**0.72**	**594**	**2.90**	**462**	**5.85**	**107**	**9.12**	**314**	**14.79**	**314**	**120.5**

DIETARY EXPOSURE

24. The dietary exposure to dried figs has not been evaluated yet. This fruit is not consumed throughout the whole year; mostly it is consumed during Christmas. Figs are not consumed as much as tree nuts and they are not usually used as ingredients of any foodstuff.

PREVENTION of AFLATOXIN IN DRIED FIGS

25. Prevention of aflatoxin contamination is more difficult to achieve in dried figs than in tree nuts. As it is mentioned above, during the formation and harvesting stages, the risk of aflatoxin formation becomes higher.

26. There is an opportunity to leave the aflatoxin contaminated fruit in a contaminated lot during processing. All dried figs are examined under UV lights and the aflatoxin contaminated as well as damaged fruits are separated. Typically, nearly 1,5 % of a lot are separated.

27. Aflatoxin contamination can be further reduced by implementing good storage and transportation procedures. The rate of aflatoxin contamination has been observed to change from year to year depending mainly on the climatic conditions. Good agricultural practices should be implemented in the orchard and continued through until the dried figs are processed and ready for distribution to consumers.

REGULATORY LEVELS FOR AFLATOXIN IN DRIED FIG

28. Turkey has established a maximum level for aflatoxin in dried fig as 5 µg/kg for B1 and 10 µg/kg total (13).

29. The European Union has established a maximum level of 2 µg/kg for B1 and 4 µg/kg total aflatoxins for dried fruit and processed products thereof, intended for direct human consumption or use as an ingredient in foodstuffs and of 5 µg/kg for B_1 and 10 µg/kg total aflatoxins for dried fruit to be subjected to sorting, or other physical treatment, before human consumption or use as an ingredient in foodstuffs. Because dried figs are accepted as processed, 2 and 4 µg/kg limits are applied to B_1 and total aflatoxins respectively to this fruit.

30. In addition to this, a draft level of 8 µg/kg for ready to eat almond, hazelnut and pistachios and 15 µg/kg for almond, hazelnut and pistachios which are intended for further processing was proposed by the 38th CCFAC.

CONCLUSIONS AND RECOMMENDATIONS

31. This discussion paper on aflatoxin in dried figs results in proposing the following recommendations for discussion at the 1st session of CCCF;

- It is recommended that a code of good practices be established by the Codex in order to prevent and reduce contamination by aflatoxin in dried figs. Turkey, as one of the largest producer, has implemented such a code; it would be advisable to use this Code as a basis for the elaboration of a Codex Code. Some points in this Code are more or less similar to the points in the Codex standard (CAC/RCP 59 -2005) "Guideline for the prevention and reduction of aflatoxin contamination in tree nuts"
- To ensure that all climatic and agricultural conditions are considered, it is appropriate that all dried fig producing countries participate as members of the drafting working group to develop the Code of Practice.

32. The establishment of a maximum level for aflatoxins in dried figs should be considered by Codex after the Code of Practice has been developed.

ANNEX I

Project Document

Proposal for new work on a "Code of practices for the prevention and reduction of aflatoxin contamination on dried figs."

1. The purpose and scope of the standard

To develop a draft Code of practices for the prevention and reduction of aflatoxin contamination of dried figs. The code will cover cultivation practices, drying, storage, transportation of dried figs.

2. Its relevance and timeliness

Measures can be taken to prevent and reduce the presence of aflatoxin in dried figs. Aflatoxins, especially aflatoxin B_1, are genotoxic carcinogens, hazardous to human health. They can be formed in many of the foodstuffs including milk and dried fruits. JECFA concluded at its 49th session that reducing the permitted quantity of AFB1 in peanuts from 20 µg/kg to 10 µg/kg would not result in any observable difference in rates of liver cancer. The 38th session of CCFAC agreed to request JECFA to conduct a dietary exposure assessment on tree nuts (ready to eat), in particular, almonds, hazelnuts, pistachios and Brazil nuts, and its impact on exposure taking into account hypothetical levels of 4, 8, 10 and 15 µg/kg, putting in the context of exposure from other sources and previous exposure assessments on maize and groundnuts.

3. The main aspects to be covered

The draft code of practice will cover all possible measures that have been proven to prevent and reduce aflatoxin contamination in dried figs. It will also cover all stages of the production chain (cultivation, harvesting, drying, storage, transportation)

4. An assessment against the criteria for the establishment of work priorities

This proposal is consistent with the following criteria for the establishment of work priorities:

a) Consumer protection from the point of view of health by minimizing consumer dietary exposure to aflatoxin from dried figs.

5. Relevance to codex Strategic objectives

This proposal is consistent with the Strategic Vision statement of the strategic Framework 2003 – 2007.

6. Information on the relationship between the proposal and other existing Codex documents

This new work is recommended in the Discussion paper on aflatoxin in dried figs to be presented and discussed at the 1st Session of Codex Committee on Contaminants in Foods (CCCF).

7. Identification of any requirement for and availability of expert scientific advice

Not currently available.

8. Identification of any need for technical input to the standard from external bodies

As the International Tree Nut Council has the "Observer Status" in the Codex Alimentarius Commission (CAC) and participates in the activities of CAC and will continue to participate in the activities of CCCF as in CCFAC, there is no need for the additional technical input from external bodies.

9. The proposed time line for completion of the new work, including the start date, proposed date for adoption at step 5/8 and the proposed date for the adoption by the Commission

If the Commission accepts, in 2007, the proposal for new work should proceed, the draft Code of Practice will be drafted and will be circulated for consideration at step 3 at the 2nd meeting of CCCF. Adoption at step 5 is planned for 2009 and adoption at step 8 can be expected in 2010.

REFERENCES

1. Safety evaluation of certain food additives and contaminants, WHO Food Additives series 40, 49th Meeting of the JECFA 1998.

2. Reddy, S.V. and F. Waliyar, Properties of Aflatoxin and It Producing Fungi, (www.aflatoxin.info)

3. Ananth S Bommakanti, and Farid Waliyar, Importance of Aflatoxins In Human and Livestock Health (www.aflatoxin.info)

4. U. Aksoy, H.Z. Can, S. Hepaksoy, N. Şahin, İncir Yetiştiriciliği TUBİTAK Türkiye Tarımsal Araştırma Projesi Yayınları (Fig growing, Turkey Agriculture Research Project Publications) 2001.

5. U. Aksoy, N. Şahin, İncir Çeşit Kataloğu Tarımsal Üretim ve Geliştirme Genel Müdürlüğü, Erbeyli İncir Araştırma Ensititüsü Müdürlüğü (Catalogue of Fig Varieties, General Directorate of Agriculture Production and Development, Erbeyli Fig Research Institue) 2001.

6. Doster MA, Michailides TJ, Production of bright greenish yellow fluorescence in figs infected by Aspergillus species in California orchards 1998, Department of Plant Pathology, University of California, Davis and Kearney Agricultural Center, Parlier 93648, USA Plant-Disease. 1998, 82: 6, 669-673; 34 ref.

7. Buchanan, J.R., N.F. Sommer and J.R. Fortage, 1975. Aspergillus infection and aflatoxin production in fig fruits, Appl. Microbiology, Aug. 238-241.

8. Doster, M.A. and T.J. Michailides, 1998. Susceptibility of maturing Calimyrna figs to decay by aflatoxin-producing fungi in California, Proceedings of the First International ISHS Symposium on Fig, ed. By Aksoy, Ferguson and Hepaksoy, Acta Horticulturae, 480, 187-191.

9. Haydar, M., L. Benelli and C. Brera, 1990. Occurence of aflatoxin in Syrian foods and foodstuffs, Food Chemistry, 37: 261-268.

10. Özer, K.B. and B. Derici, 1998. A research on the relationship between aflatoxin and ochratoxin A formation and plant nutrients, Proceedings of the First International ISHS Symposium on Fig, ed. By Aksoy, Ferguson and Hepaksoy, Acta Horticulturae, 480, 199-206.

11. Steiner, W.E., R.H. Reiker and R. Battaglia, 1988. Aflatoxin contamination in dried figs distribution and association with fluoresecence, Journal of Agr. And Food Chemistry, 36: 88-91.

12. Şahin, E. Sabır, 2003. Büyük ve Küçük Menderes Havzalarında Yetiştirilen Kurutmalık İncirlerde (Ficus carica) Aflatoksin ve Okratoksin A Varlığının, Dağılımının ve Kalite İlişkisinin Araştırılması EÜ Fen Bilimleri Enstitüsü (Research on Aflatoxin and Ochratoxin A Presence, Distribution and Relationship with Quality in Figs for Drying grown in Big and Small Meander Valleys Ege University Graduate School of Natural and Applied Sciences) (Unpublished Ph.D. thesis), İzmir, Turkey.

13. Turkish Food Codex Communiqué on Determining the Maximum Levels of Certain Contaminants in Foodstuffs (Communiqué No: 2002/63) Official Gazette: 23.09.2002 – No:24885.