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EFFECT OF SEEDBORNE FUNGI OF PEANUT AND STORAGE PERIODS ON CERTAIN PHYSICAL AND CHEMICAL PROPERTIES OF OILS

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Abstract

Seedborne fungi of peanut cv. Giza 5, were isolated on Blotter during three storage intervals. *Aspergillus flavus*, A. *niger*, *Aspergillus* spp. and *Penicillium* spp. were the most frequent fungi on seeds. *Aspergillus flavus* ranged from 14.0 to 29.25%. On the other hand, *Aspergillus niger*, recorded 18.25% after 4 months storage. The lowest percentage of infection by *A. niger* was 11.20% after 6 months storage.

Aspergillus spp. ranged from 12.50 up to 19.30% during three storage intervals. The physical and chemical properties fluctuated during the storage periods. Acid number ranged from 0.52 to 6.40 for diseased seeds, while it ranged from 0.39 to 3.50 for apparently healthy ones. Iodine number, saponification value, refractive indices and oil color recorded different degrees of fluctuation. The fatty acids composition also fluctuated for both the infected and apparently healthy seeds.

INTRODUCTION

Peanut like many other seeds are stored for varying periods of time after harvest (Zayed *et al.*, 1983). Therefore, the duration and conditions of storage are of great significance and greatly reflect on quality of the stored pods and seeds (Zayed & Lashin, 1974 and Nagar & Chauhan, 1977). In the present study, the effect of storage intervals and seed infection by fungi on some of the physical and chemical properties were studied. Also, the changes in the fatty acids composition were determined using GLC analysis.

MATERIALS AND METHODS

Two hundred seeds of cv. Giza 5 collected from Ismailiya Governorate were tested using blotter method to detect seedborne fungi of each storage period, the seeds were infected by different types of infection symptoms (B, C and D). Where B seeds with brown lesions, C seeds with pink discoloration and D seeds with general breakdown. The seed samples were stored at room temperature for six months and tested each period for the associated fungi according to ISTA (1985).

Physical and chemical properties of peanut seed oils

Two sets of peanut seeds (40 gm each) of cv. Giza 5; apparently healthy (H) and diseased seeds (D) were sun-dried and milled twice using an experimental mill. The fine powder was soaked in petroleum-ether (b.p. 68-80°C) for 48 hr. with an occasional shaking. The crude extracts were collected by decantation. The meal was soaked once more in the same solvent for another 24 hr. The compound extracts were filtered over sufficient amount of anhydrous sodium sulphate (25 g/100 ml) and the solvent was removed by distillation under vacuum. The resulting oils were kept in dark bottles in refrigerator ready for analytical purpose, for physical and chemical properties and for determining the percentage of fatty acids by means of GLC analysis as indicated in A.O.A.C. (1975).

RESULTS AND DISCUSSION

Changes in the presence and frequencies of seedborne fungi during storage reported herein were somewhat similar to those reported by earlier investigators (Joffe & Palti, 1967; Hanlin, 1970 and Joffe & Lisker, 1969).

Data reported in Table (1) generally indicate that storage durations affected the frequency of fungi isolated from diseased seeds only and this finding agreed with Asworth and Langley (1964). At zero time, *Rhizopus nigricans* (17.14%) was the most frequent fungus in diseased seeds (D) followed by *Aspergillus* spp. (16.80%). Two months after storage of diseased seeds, *Aspergillus flavus* was the most frequent fungus showing 29.25% followed by *Rhizopus nigricans* at 15.50%. After four months of storage, *Aspergillus niger* was the most frequent at 18.25% followed by *Aspergillus flavus* (14.0%). Six months of storage, *Aspergillus* spp. were the most prevalent at 19.30% followed by *Penicillium* spp. at 19.05%. In this respect, Joffe & Palti, (1967) demonstrated that storage fungi of peanut pods and seed were affected by numerous conditions, most important of which are the storage warehouses and temperature.

The effect of storage periods of diseased and apparently healthy peanut seeds on some physical and chemical properties of peanut seed oils was studied. The physical and chemical properties tested were acid number, iodine number, saponification value, refractive index and oil color.

Data in Table (2) show that acid number (A.N.) of the extracted crude oil from diseased seeds was higher than that of oils extracted from apparently healthy seeds. The A.N. ranged freon 0.52 at zero time to 6.40 after six months of storage of dis-

Table 1. Effect of different storage periods on frequency of fungi associated with diseased and apparently healthy peanut seeds.

Fungi isolated	Storage periods (months)							
	Zero time		2		4		6	
	Diseased seeds***	Apparently healthy	Diseased seeds	Apparently healthy	Diseased seeds	Apparently healthy	Diseased seeds	Apparently healthy
Aspergillus flavus	16.00**	0.00	29 25	0.00	14.00	0.00	16.25	0.00
Aspergillus niger	14.25	0.00	12.5	0.00	18.25	0.00	11.20	0.00
Aspergillus spp.	16.80	0.00	14.5	0.00	12.50	0.00	19.30	0.00
Fusarium moniliforme	0.00	0.00	0.00	0.00	12.00	0.00	8.50	0.00
Fusarium oxysporum	8.13	0.00	0.00	0.00	0.00	0.00	12.50	0.00
Fusarium solani	0.00	0.00	12 50	0.00	12.25	0.00	13.20	0.00
Penicillium spp.	12.50	0.00	10.25	0.00	10.25	0.00	19.05	0.00
Rhizopus rigricans	17.14	0.00	15.50	0.00	6.50	0.00	0.00	0.00
Rhizoctonia solani	5.25	0.00	0.00	0.00	10.00	0.00	0.00	0.00
Sclerotium rolfsii	9.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
* *Others*	0.43	0.00	5.50	0.00	4.25	0.00	0.00	0.00

* Others = Unidentified fungi

** (%) = Fungi isolated from 200 peanut seeds of cv. Giza 5 on blotter.

*** Infected seeds with different symptom types (B, C & D).

Table 2. Effect of storage periods on physical and chemical properties of apparently healthy and diseased peanut seed oils.

Oil properties	Storage periods (months)							
	Zero time		2		4		6	
	Diseased seeds	Apparently healthy	Diseased seeds	Apparently healthy	Diseased seeds	Apparently healthy	Diseased seeds	Apparently healthy
Acid number	0.52	0.39	1.06	0.79	4.70	2.50	6.40	3.50
Iodine number	90.20	91.60	93.00	89.10	94.30	92.80	96.23	94.50
Saponification value	198.90	199.50	197.20	201.50	200.80	201.30	199.80	203.20
Refractive index	1.4712	1.4711	1.4715	1.4761	1.4714	1.4713	1.4722	1.4740
Oil colour	LY	LO	RO	LO	RO	LY	RO	LR

*LY = Light Yellow LR = Light Red

LO = Light orange RO = Red Orange

eased seeds compared to the values 0.39 to 3.5 in the healthy ones. Iodine number (I.N.) of crude oil of diseased seeds ranged from 90.20 at zero time to 96.23 after six months of storage, respectively. On the other hand, the I.N. of oils extracted from apparently healthy seeds ranged from 91.60 to 94.50 at zero time and six months of storage, respectively. There were no clear differences in saponification value (S.V.) of oil from diseased and apparently healthy seeds at all storage periods. Saponification value (S.V.) recorded 198.90 to 199.80 in the case of diseased seeds during storage period, while it ranged from 199.50 to 203.20 for apparently healthy ones. Concerning the refractive indices (Ref. Ind.), it fluctuated from 1.4712 to 1.4711 for oils of diseased and apparently healthy seed at zero time, and fluctuations were negligible over storage. The color of oil extracted from diseased seeds was light yellow (LY) at zero time, turned to the reddish orange (RO) after 2, 4 and 6 months of storage. The oil color of apparently healthy seed oils were LO, LO, LY and LR, respectively. The high acid values of oil extracted from diseased seeds may be due to difference in lipolytic activities of different fungal species colonizing the seeds during storage (Zayed & Lashin, 1974 and Farag *et al.*, 1980). The limited variation in the iodine number of oils extracted from apparently healthy and diseased peanut seeds may be ascribed to the presence of a slight biohydrogenation of the double bonds or other reactions in the unsaturated fatty acids. The close similarity of saponification values of oils extracted from apparently healthy and diseased ones denotes that the fatty acids of both oils have similar chain length (Zayed and Lashin, 1974). Also, Farag *et al.* (1980 & 1986), meanwhile reported no noticeable differences in refractive indices of oils extracted from apparently healthy and diseased peanut seeds. It was expected that both oils had the same composition or content of unsaturated fatty acids.

Data presented in Table (3) indicated that both saturated and unsaturated fatty acids were greatly increased in diseased peanut seeds at all storage intervals compared with those of the apparently healthy seeds as evidenced by data obtained for linoleic acid (18:2) in oil extracted from diseased seeds ranged from 6.50% at zero time up to 9.05 after six months of storage. On the other hand, linolinic acid (18:3) was detected only in oils of diseased seed with 3.0% at zero time. Oleic acid (18:1) was 19.20%, 21.79% and 0.82% at three storage intervals for diseased seeds, respectively. The total content of unsaturated fatty acids decreased in diseased seeds from 28.70% to 9.87% of the 6 months.

Regarding the saturated fatty acids, it was increased greatly in oil extracted from diseased peanut seeds from 13.61% to 32.54% by increasing storage time. On the other hand, the total saturated fatty acid was not increased in the apparently healthy seeds by increasing storage period.

Table 3. Effect of storage periods on the fatty acids composition of apparently healthy and diseased peanut seed oils.

Fatty acids		% FA** at zero time		% FA after 2 months		% FA after 6 months	
		Diseased ***	Apparently healthy	Diseased ***	Apparently healthy	Diseased ***	Apparently healthy
Unsaturated							
Linoleic	(18:2)*	6.50**	2.10	5.66	1.04	9.05	5.83
Linolenic	(18:3)	3.00	0.00	0.00	0.00	0.00	0.00
Oleic	(18: 1)	19.20	7.50	21.79	0.00	0.82	0.00
Palmitoleic	(16: 1)	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	28.70	9.60	27.45	1.04	9.87	5.83
Saturated							
Arachidic	(20:0)	0.00	3.00	0.00	0.00	9.37	0.00
Behinic	(22:0)	0.00	0.00	0.00	0.00	0 00	0.00
Caproic	(6:0)	2.10	0.00	3.02	0.00	9.57	0.00
Caprilic	(8:0)	0.00	0.00	2.09	0.00	1.96	0.00
Capric	(10:0)	0.00	0.00	1.16	0.86	1.15	0.00
Lauric	(12:0)	3.11	0.00	1.52	0.78	1.71	0.25
Myristic	(14:0)	4.30	1.50	4.08	1.04	5.94	3.91
Palmitic	(16:0)	2.60	0.00	5.69	2.79	2.84	2.31
Stearic	(18:0)	1.50	0.96	0.56	0.00	0.00	0.30
	Subtotal	13.61	5.46	18.12	5.47	32.54	6.77
Total		42.31	15.06	45.57	6.51	42.41	12.60

* No. of carbon atoms. ** FA = % fatty acids content. *** Infected seeds with different symptom types (B, C and D).

Arachidic acid (20:0), in the apparently healthy seeds was 3.0% before storage and recorded 9.37% in diseased seed oil after six months of storage.

Myristic acid (14:0) was detected in oil of diseased seeds at all intervals ranging from 4.30 to 5.94 at zero time and six months storage. Stearic acid (16:0) ranging from 2.60 at zero time up to 2.84% after six months storage, whereas in oils of apparently healthy seeds it was 2.79 and 2.30 after two and six months of storage in both healthy and diseased seeds, while linoleic acid was the only unsaturated fatty acid which did not increase. On the other hand, lenolinic, oleic, lauric and stearic fatty acids decreased or completely disappeared in healthy and/or diseased seeds at the end of six months of storage. In this respect, Khalil *et al.* (1995) found that oil extracted from infected seeds showed an increase in the concentration of saturated fatty acids, while the unsaturated ones decreased as the infection progresses. On the other hand, Hafez *et al.* (1996) found that inoculated soybean seed stored for 2 months showed an increase in palmitic, stearic and oleic acid with sharp decrease in linoleic acid. In addition, further reduction in saturated fatty acid contents in the inoculated seeds was detected compared with that in the uninoculated ones at the same storage interval. It is obvious that storage durations have a significant influence on some of the properties of peanut seeds due to the fungal colonization of seeds.

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تأثير الفطريات المحمولة ببذور الفول السودانى وفترات التخزين على بعض الخصائص الطبيعية والكيميائية للزيت

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تم عزل الفطريات المحمولة ببذور الفول السودانى الصنف جيزة ٥ باستخدام طريقة البلوتر وذلك على ٣ فترات تخزينية. وكانت الفطريات اسبرجلس فلافس، اسبرجلس نيجر، بنسيليوم بأنواعه هى الأكثر تكراراً على البذور. وكانت نسبة تكرار الفطر اسبرجلس نيجر ١٨,٢٥ ٪ بعد ٤ شهور تخزين. على حين كانت أقل نسبة إصابة بالفطر اسبرجلس نيجر هى ١١,٢٠ ٪ بعد ٦ شهور من التخزين. تراوحت نسبة تكرار الفطر اسبرجلس بأنواعه من ١٢,٥٠ إلى ١٩,٣٠ ٪ على ثلاث مراحل تخزينية. تأرجحت الصفات الطبيعية والكيميائية أثناء فترات التخزين. حيث تراوح رقم الحموضة من ٨,٥٢ وحتى ٦,٤٠ للبذور المصابة. على حين تراوحت من ٠,٩٣ حتى ٣,٥٠ للبذور السليمة ظاهرياً. سجل كل من الرقم اليودى، رقم التصبن، معامل الإنكسار، درجة لون الزيت درجات مختلفة من الاختلاف. على حين تأرجح محتوى البذور المصابة والسليمة ظاهرياً من الأحماض الدهنية.