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TREATMENT OF PEANUT SEEDS WITH MINT AND CLOVE ESSENTIAL OILS TO ELIMINATE FUNGAL LOAD AND AFLATOXINS PRODUCTION IN THE FINAL YIELD

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ABSTRACT

This study was conducted to evaluate the antifungal effect of mint (*Menthapiperita*) and clove (*Syzygiumaromatic*) essential oils on the fungal load, aflatoxins production and final yield of peanut crop(*Arachis hypogea*).Three species of peanut seed (Gregory, Giza 6 and Ismailia 1) were inoculated by *A.flavus* then treated with mint and clove essential oils (EO) and chemical antifungal vitavax to study their antifungal effect on the peanut yield after cultivation of contaminated seeds for two seasons.The yield of treatedpeanut seeds with mint and clove EOwas free from aflatoxins compared with the yield treated by chemical antifungal vitavix which gave 8ppb , 20ppb and 15 ppb of total aflatoxins in Gregory , Giza and Ismailia 1 peanut seeds, respectively. Mint EO decreasedthe number of total fungi in first season from $15x10^4$, $29x10^4$ and $31x10^4$ to $7x10^2$, $8x10^3$ and $16x10^3$cfu/gin Gregory , Giza 6 , Ismailia 1 peanut seeds, respectively .Similar result was obtained in second season .Regarding to peanut hulls, the treatment with clove EO eliminate the total fungi in contaminated peanut seed from $18x10^4$,$3.2x10^5$ and $3.3x10^5$ to $9x10^3$,$14x10^3$ and $16x10^3$cfu/g in Gregory , Giza 6 and Ismailia 1, respectively in second season . No aflatoxins were detected in all samples whereasthe total fungi was ranged from $9x10^4$ to $8.2x10^5$cfug.The common fungal spices were as follows: *Rhizopus* spp., *Mucor spp., A.niger, Fusariumvericilliodis, Penicilliumaurantiogriscum, Penicilliumhirsutum, Alternaria, alternate, and Talaromycesmacrosporus*. No aflatoxins were detected in all samples of peanut hulls, but it has high load of fungi which was ranged from $9x10^4$ to $82x10^4$cfu/g. Changes in Morphological traits, yield parameters and crude oil percentage were determined as agronomic characters.Results ratifies that the interaction among genotypes (Giza 6 , Ismailla 1, Gregory) and treatments (control , treatment with mint oil ,clove oil and vita ax) were significant on all estimated traits over the two seasons. Gregory with treatment (mint oil) gave the highest values of all studied characters compared to all other treatments over the two seasons followedbygenotype (Giza 6) combination with treatment with clove oil.

Keywords : Antifungal Activity, Aflatoxins, Peanut seeds, Essential oils.

INTRODUCTION

Peanut (*Arachis hypogea* L.) is an important oil seed crop, and major food legume., cultivated in over 100 tropical and subtropical countries. The seed has several purposes as whole seed or processed to make peanut butter, oil soups, stews and other products. The protein, oil, fatty acid, carbohydrate and mineral content of this nut becomes sensitive to fungal contamination in pre and post- harvest stageUSDA , (1978) .

The fungal contamination is one of the main problems when inappropriate processing and storage condition occur(Asis*etal.*, 2005).Contamination of peanut with

mycotoxinsparticularly afatoxins, is a worldwide problem that affects both food safety and agricultural economies. Most countries have adopted regulations that limit the quantity of total aflatoxins in food and feed as20 ppb or less; however, environmental conditions in most of the world where peanut are produced and stored often make it difficult or impossible to attain such low concentrations. In addition to aflatoxins, peanut are often contaminated with cyclopiazonic acid (CPA). Both mycotoxins are produced by Aspergillusflavus , as ubiquitous fungus that can infect and grow on peanut under both pre and post- harvest conditions(Dorner.,2008). Contamination can occur during various stages of production, harvest, handling and storage(Dieneret al.,1987). Pre-harvest aflatoxin contamination of peanuts is associated with late- season drought conditions as peanut begin to dehydrate in the soil under hot, dry environmental conditions(Cole *et al* ., 1989).Contamination can also occur after peanut are dug if they are not quickly harvested, dried and maintained at a safe moisture level (Bluma *and* Etcheverry. 2008).Aflatoxins are secondary metabolites produced by *Aspergillusflavus, A. parasiticus, A. nomiusn, A. tamari and A. bombycis* (Kurtzman*et al*., 1987; Goto*et al*., 1997 and Peterson *et al*., 2001). These toxins are acutely and chronically toxic to both humans and animals (Dvorackova, 1990). Among the most potent mutagenic and carcinogenic compounds known to be produced in nature, consumption of mycotoxin contaminated foods has been associated with several cases of human poisoning or mycotoxicosis, sometimes resulting in death (Abdelhamid*et al*.1999 and Bathnagar and Garcia,2001). Control measures to prevent fungal growth and aflatoxins production include chemical control (Bauer, 1994; Codifier *et al*., 1976 andHasan, 1998)., natural products and essential oils prevent much of the contamination that occur and reduced concentrations of aflatoxins in peanuts. Plants produce lots as secondary metabolites as part of their normal growth and development. One of the most important secondary metabolites are essential oils (Eos), which are extracted from plants, commonly by a distillation process (Teissedre*and Waterhouse*.,2000) and then used as natural additives in different foods to reduce the proliferation of microorganism and their toxins production due to their antifungal , antioxidant and anticarsionogenic properties (Bruneton,. 1995) They have received major consideration in regard to their relatively safe status and enrichment by a wide range of structurally different useful constituents(Farag*et al*., 1989). There have been many reports regarding the antifungal properties of plant essential oils. Some of these oils include thyme (*Thymus vulgaris L.) (Thompson and Cannoin, 1986; andZambonelli et al., 1996),*cinnamon*(Cinnamomunzeylanicumblume),clove (Syzygiumaromaticum (L.) (Thompson and Cannion, 1986 andChatterJee, 1990); Pimenta (Capsicum anuum L.) Thompson and Cannion 1986,and basil (Ocimumbasillicum L.) (*ChatterJee, 1990; andBasilico and Basilico, 1999).The extent of the inhibition of essential oils could be attributed to the presence of an aromatic nucleus containing a polar functional group being phenols, steroids and tannins. Antifungal of mint Eo is reported in other investigations(Duarte *et al*., 2005);Sokovic& Van Griensven,2006,(Gulfraz*et al*., 2008), and Ferreira(2011). Mint oil (*Menthapiperita*L.) , commonly called

peppermint is a well – known herbal remedy used for a variety of symptoms diseases. Among the indentifiedcompound some had already been reported as having antimicrobial activity, including cineole, limonene, linalool and menthol (Mazzanti*et al*., 1998) and(Iscan*et al*., 2002.). theantifungal effect of mint Eos can be attributed to menthol and 1.8- cineole which exhibited very good antifungal properties (Griffin *et al*., 2000). The biosynthesis of aflatoxin can be inhibited by extracts Eos from certain plants toxic to fungi and can control the fungal growth and mycotoxin production (Pinto *et al*.,2001),Omidbeygi*et al*.(2007) observed Inhibition of growth of Aspergillusflavus by using clove oil (*Syzygiumaromaticum*) and reported the percentage of inhibition as 87 %.

This study aimed to investigate the efficiency ofmint and clove essential oilsto fungal growth, aflatoxin production and seed yield of three cultivars of peanut .

MATERIALS AND METHODS

Essential plant oils :

The essential plant oils of mint (*Manthapiperita*) and clove (*Syzygiumaromaticum*) were 100% pure according to the manufactures and purchased from the Health Shop Pharmacy, Cairo, Egypt.

Artificial infection with A. flavus:

Seeds were surface disinfected for 1 min using 1% sodium hypochlorite, rinsed three times with sterile distilled water and allowed to dry. Seeds were inoculated with A. flavus(NRRL 3145,Plant Pathology Department, Agriculture Research Center).spores. A suspension of 10^6cfu/ml of A. flavus spores was prepared according to **Davis *et al*., (1966).** The spore suspensions were poured through muslin cloth into flasks. The seeds were added to the suspensions and mixed thoroughly. Flasks were incubation at 25°C for 5 days.

Treatment of contaminated seeds two days before sowing

1-The control : contaminated peanut seeds cultivars were prepared without treatment.
2-Treatment of contaminated peanut seeds cultivars with mint oil (10ml/ kg seed)and mixed well.
3-Treatment of contaminated peanut seeds cultivars with clove oil (10ml/ kg seed) and mixed well .
4-Treatment of contaminated peanut seeds cultivars with vitavax (200) 75 WP (3 g/kg seed) aschemical antifungal ,commercial product.
5-After a brief drying period (5min.) , the seeds were packed into paper bags.

Field trial: The contaminated cultivars Giza 6, Ismailia 1 and Gregory peanut were used in this study. The pedigree of these cultivars is shown in Table (1). Seeds were sown during the summer seasons in 2011 and 2012 at Ismailia Research Station (ARC) infection field. The treatments were arranged in split plot design with three replications in both seasons .The main plots were occupied with three contaminated cultivars and sub plothad four treatmentsEach entry was grown in a plot area of 10 m2 (4.0 × 2.5 m). Sowing dates were 15th June 2011 and 2012, the cultural practices were done according to recommendations methods. The observations were

recorded on randomly collected plants per plot for the following agronomic characters:
1. Morphological traits: Plant height (cm), number of branches pl-^{1}., number of pods pl-^{1} and number of seeds pl-^{1}
2-Yield parameters: At harvest, pods yield pl-^{1}. (g), seed yield pl-^{1}. (g), pods yield fad-^{1}(ard.), seed yield / fad (Kg.) and shelling % were estimated.
3-Crude oil:Percentage was determined using soxhlet apparatus and hexane as solvent according to **AO AC (2004)**
Analysis of variance was calculated for each season separately according to **Mather and links (1982).**According to homogeneity test, the results of 2011 and 2012 did not differ significantly, so the combined analyses of the two seasons were conducted.

Table 1. Pedigree of peanut genotypes studied.

Genotypes	Origin	Pedigree
Giza 6	Egypt	Commercial cultivars
Ismailia 1	Egypt	Selected from Giza 4 × line 182
Gregory	U.S.A	Unknown

Analysis of aflatoxins :

Aflatoxins were determined according to (AOAC, 2004).Weight 25 g test portion into blender jar. Add 5g NaCl and 125 ml extraction solvent. Blend 2 min at high speed. Filter through prefoldedpaper. Pipt 15 ml filtrate into 125 ml glass-stopper Erlenmeyer flask. Add 30 ml H_2O, stopper and mix. Filter diluted extract through glass microfiber paper ≤ 30 min before affinity column chromatography. Pass 15 ml filtrate through the affinity column (Vicamcompany, USA). Push distilled water through column (10 ml). Add 1 ml L. C grade CH_3OH to elute the toxins. Collect elute and inject it through HPLC technique to determine values of Aflatoxins. HPLC system from U.S.A, Agillent company 1200), with column C18 (Lichrospher 100 RR-18), 5 mm x25 cm according to the following technique: the mobile phase consisted of water: methanol: acetonitrile (54: 29: 17, v/v/v) at flow rate 1 ml/min. The excitation and emission wavelengths for all aflatoxins were 362 and 460 n.m (Florences detector), respectively (Roos*et al.*, 1997).

Total count of fungi :

Ten grams of each sample were added to 90 ml portion of sterile saline solution (0.85% NaCl) in 500 ml Erlenmeyers flask and homogenized thoroughly on an electric shaker, at constant speed 15 min.,ten fold serial dilutions were then prepared . One ml portion of suitable dilutions were used to inoculate Petri dishes containing 15 ml Rose Bengal Agar fortified by 0.5 mg chloromphnicol/ml medium. Plates were counted after 3 days of incubation. The plates containing fewer than 150 colonies were retained (Paper and Fennel, 1977).

RESULTS AND DISCUSSION

A. Effect of variety and four treatmentson morphological characters of peanut

a) Varietal differences.

Data presented in Table (2) show that the three contaminated peanut cultivars significantly differed in all traits over the two seasons, except number of pods pl^{-1}. It is clear that V_3 showed superiority in most of the studied traits.These results are in agreement with those reported by **Naguib*et al.* (2011).**

b) Treatment differences :

Data presented in Table (1)reveal that all the studied Traits were significantly affected by the four treatments. The maximum values of branch pl^{-1}, plant height (cm), pod length (cm), number of pods pl^{-1} and number of seeds pl^{-1} . were obtained when using T_2 followed by T_3, T_4 and T_1,respectively.

c) Effect of interaction :

All studied morphological characters were affected significantly by the interaction between the three studied cultivars and the four treatments (table2)

B- Effect of variety and four treatments on yield characters of peanut.

a)Varietal difference

Results in Table (3) indicated that all studied yield characters were differed over the two seasons , where V_3 gave the highest pod weight pl^{-1} (48.7g), seed weight pl^{-1} (37.0g), weight 100 pod(188g), weight of seed from 100 pod (123.0g) , pod weight / fed (ardeb) (17.25) and oil percentage (47.3) ,except shelling % was equal with other varieties.These results are in agreement with those reported by Naguib*et al* (2011).

b) Treatment differences :

Results in Table (3) indicate that all studied yield characters were significant by affected by treatment.It is clear that T_2 resulted in the greatest effect on pod weight pl^{-1} (47.1g), seed weight pl^{-1} (36.2g) , weight 100 pod (197.4g), weight of seed from 100 pod (133.7g), shelling (68.08%), pod weight/ fed/ ardab (16.67) and oil % (47.6)

Also, it is clear that the maximum values were obtained when using T_2 followed by T_3 , T_4 and T_1, respectively. These results agree with those obtain byCraufurd*et al.* (2006) who mentioned that there were negative linear relations between aflatoxin concentration and pod yield.

C) Effect of the interactions on peanut yield and its attributes

Results in Tables, (2 and 3) ratify that the interactions among genotypes (Giza 6, Ismaillia 1 and Gregory) and treatments (control, treatment with mint oil, clove oil and vitavax)were significant on all estimated traits over two seasons , except shelling %

At genotype (Gregory) in combination with the treatment (mint oil) gave the highest values of all studied characters compared to all other treatments over two seasons followed by genotype (Giza 6) in combination with treatment 3 (clove oil).

Table(2):Mean Performance for some morphological characters of peanut genotypes (combined data).

Characters / Treatments	Morphological characters			No. of pods / pl^{-1}	No. of seeds pl^{-1}
	No. of branch pl^{-1}	Plant height (cm)	Pod length (cm)		
Varieties (V)					
V1	5.7	30.2	3.1	25.1	37.0
V2	5.6	33.0	3.5	26.7	38.7
V3	6.1	37.0	3.7	28.2	44.2
L.S.D at 5%	0.2	1.2	0.2	4.3	4.9
Treatment					
T1	5.0	31.4	3.4	24.5	37.9
T2	6.9	37.6	3.6	28.5	42.6
T3	6.0	34.3	3.4	27.5	40.3
T4	5.3	30.3	3.3	26.1	39.2
L.S.D at 5%	0.3	1.6	0.2	2.2	3.7
interaction					
V1T1	4.8	26.5	3.1	22.2	36.8
V1T2	6.6	36.3	3.2	27.1	37.6
V1T3	6.0	30.3	3.0	25.3	35.9
V1T4	5.3	27.5	3.1	24.9	37.0
V2T1	4.8	32.7	3.6	24.6	38.6
V2T2	7.0	37.2	3.7	28.2	38.7
V2T3	5.8	33.0	3.6	27.7	41.1
V2T4	4.9	29.1	3.3	26.9	35.6
V3T1	5.5	34.9	3.6	25.9	37.6
V3T2	7.1	39.2	4.1	30.3	51.8
V3T3	6.3	39.7	3.7	28.8	46.6
V3T4	5.6	34.4	3.3	27.2	41.5
L.S.D at 5%	0.6	2.8	0.3	3.8	6.4

It is clear that the best interaction affect was registered for the V_3 with T_2 and V_3 with T_3. Data clear that the highest values of these characters were scored by Gregory cultivar and mint oil treatments .

The effects of treatment of peanut seeds with mint and clove essential oils to eliminate fungal load and aflatoxins production in yield of first season are shown in tables 4. The essential oils of mint and clove inhibited the growth of *A. flavus* compared with the control. The essential oils of mint and clove produced peanut yield free of aflatoxins when compared with these produced from peanut seeds without any treatments or other treated with the commercial chemical antifungal (vitavax). The essential oils of mint and clove inhibited the growth of *A. flavus* when compared with the controls. On contrast,the seeds treatment with essential oils showed the lowest levels of fungal total counts ($7x10^2$for mint oil and $2.0x10^4$cfu/g for clove oil). Seeds without any treatment (control) showed the highest level oftotal fungal count ($3.1x10^5$cfu/g) in Ismailia 1 peanut seeds as shown in Tables 4. These values ranged from $7x10^2$ to $2.0x10^4$cfu\g in case of oils treated seeds, while it were ranged from $15x10^4$cfu/g to $3.1x10^5$ in case of the control as seen in same Table .

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Table (4): Effect of mint and clove essential oils on fungalload , totalaflatoxinsand isolated fungi in peanut yield of the first season:

Treatment / Peanut genotypes		Contaminated seeds (control)		Vitavax		Mint oil		Clove oil	
		Seeds	Hulls	Seeds	Hulls	Seeds	Hulls	Seeds	Hulls
	T.F.C*	$15x10^4$	$5.5x10^5$	$16x10^3$	$18x10^4$	$7x10^2$	$12x10^4$	$13x10^3$	$9x10^4$
Gregory	F.I**	1,2,3	3,4,5,7	4,5	4,5	4,5,7	4,5	4,5	4,5
	T.A***	22	0.0	8	0.0	0.0	0.0	0.0	0.0
	T.F.C*	$2.9x10^5$	$8.2x10^5$	$2.2x10^4$	$2.0x10^5$	$8x10^3$	$3.5x10^5$	$16x10^3$	$12x10^4$
Giza 6	F.I**	1,2,3	3,4,7,8	4,5	2,4,5	4,5	2,3,4,5,8	4,5	4,5,7
	T.A***	37	0.0	20	0.0	0.0	0.0	0.0	0.0
	T.F.C*	$3.1x10^5$	$3.4x10^5$	$2.3x10^4$	$3.4x10^4$	$16x10^3$	$4.3x10^5$	$2.0x10^4$	$5.7x10^5$
Ismailia1	F.I**	1,2,3	3,4,8,9	4,5	2,4,5	3,6	4,5,6	4,5	4,5
	T.A***	25	0.0	15	0.0	0.0	0.0	0.0	0.0

T.F.C*: Fungi Total count (cfu/g), F.I: Fungal isolates. T.A***: Total aflatoxins (ppb).**
1= *Aspergillusflavus.* , 2= *Aspergillusniger,* 3= *Fusariumverricillidis.*, 4= *Rhizopus spp.*,
5= *Mucor spp.* 6= *Talaromycesmacrosporus.* 7= *PEnicilliumaurantiogriscum.*
8-*Penicillium hirsutum.* 9= *Alternaria alternate.*

The yield of peanut seeds treated with mint and clove essential oils showed high activity against aflatoxins production, where seeds were free of aflatoxins, while level of total aflatoxins were 8 ppb, 20 ppb and 15 ppb in case of yields produced by treated seeds with chemical antifungal product (vitavax) in the three investigated varieties (Gregory, Giza 6, and Ismailia, respectively). High levels of total aflatoxins were found in case of seeds without any treatment (control), it reached to 22 ppb, 37 ppb, and 25 ppb in Gregory,Giza6 and Ismailia 1, respectively .

The given data showed that the fungal load of peanut hulls was higher than that of peanut seeds. It was ranged from $9x10^4$cfu/g in treated hulls with clove oil in Gregorytypeto $8.2x10^5$cfu/g for control.On the other hand, all samples of peanut hulls were free of aflatoxins,Contrary to abdelhamid (1990) who found that contained (20 folds) than peanut seeds of the same naturally infectedpods .

Data in Table (5) cleared that mint and clove Eos. Were very closed in the effect of decreasing the total fungal counts in treated peanut seeds ,where the highestnumber of total fungal counts was $3.3x15^5$cfu/g in control peanut seeds(Giza 6) and $3x10^4$cfu/g in treated peanut seeds with Vitavix, whereas total fungal counts of treated peanut seedswith mint and clove EOs. Were $9x10^3$(clove EO.) and $11x10^3$cfu/g (mint EO.).All treated peanut seeds with Eos were free from aflatoxins. *Rhizopus spp. ,Mucor spp.* And were the most predominant fungal isolates from all treated peanut seeds and hulls (Vitavix and Eos.), also *A. flavus, A. niger* and *F. verricillidis* disappeared in vitavix,mint and clove oils in the yield of second season.It was also noted that the variety of peanut Gregory had a lower incidence of fungi than the other varieties.

Table (5): Effect of mint and clove essential oils on fungal load,total aflatoxinsand isolated fungi in peanut yield of the second season:

Peanut genotypes \ Treatment		Contaminated seeds (control)		Vitavax		Mint oil		Clove oil	
		Seeds	Hulls	Seeds	Hulls	Seeds	Hulls	Seeds	Hulls
	T.F.C*	$18x10^4$	$4.4x10^4$	$2.6x10^4$	$2.2x10^5$	$11x10^3$	$16x10^4$	$9x10^3$	$13x10^4$
Gregory	F.I**	1,2,3	3,4,7,8	4,5	2,4,5	2,5,7	4,5	4,5	4,5
	T.A***	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	T.F.C*	$3.2x10^5$	$7.6x10^5$	$2.4x10^4$	$3.1x10^4$	$15x10^3$	$3.1x10^5$	$14x10^3$	$16x10^4$
Giza 6	F.I**	1,2,3	3,4,6,7,8	4,5	2,4,5	4,5	4,5	4,5	4,5
	T.A***	40	0.0	15	0.0	0.0	0.0	0.0	0.0
	T.F.C*	$3.3x10^5$	$3.7x10^5$	$3.0x10^4$	$3.0x10^5$	$14x10^3$	$3.8x10^5$	$16x10^3$	$4.4x10^5$
Ismailia1	F.I**	1,2,3	3,4,8	4,5	4,5	4,5,6	4,5	4,5	4,5
	T.A***	35	0.0	19	0.0	0.0	0.0	0.0	0.0

F.T.C*:Total Fungi count (cfu/g), I.F: Fungalisolates., T.A***: Total aflatoxins (ppb).**
1= Aspergillusflavus. , 2= Aspergillusniger, 3= Fusariumverricillidis., 4= Rhizopus spp., 5= Mucor spp. 6= Talaromycesmacrosporus. 7= PEnicilliumaurantiogriscum. 8-Penicillium hirsutum. 9= Alternaria alternate.

The present results are correlating with Montes- Belmont and Carvajal, (1998)who reported that essential oils of peppermint (*Menthapiperita*) and clove (syzygiumaromaticum) caused a total inhibition of *A. flavus* on maize kernels. Antifungal properties of mint and clove oils on cowpea seeds have alos been recorded by Kritzinger et al., (2002). The hydrosols of anise, cumin, fennel, mint, picking herb and thym showed a strong inhibitory effect on mycelial growth of *A. parasiticus* NRRL 2999, Ozcan,(2005).Aqil et al .,(2000) observed that mint and clove essential oils can be exploited as antifungal agent in the management of plant infectious diseases and post-harvest spoilage of crops . Pundir and Jain .,(2010)reported that extract of clove was found to be highly active against *A.flavus* and this activity may be due to the presence of genol and caryophyllene.Roquia El-Habib, (2012)showed that essential oil of dill, coriander, basil, rosmar, mint and thym have antifungal activities against *A. flavus* and aflatoxin production *in vitro*. Several authors have attributed the antifungal activity of essential oils to the presence of phenolic compounds and the amphipathicity of these compounds can explain their interactions with biomembrane and thus the antimicrobial activity (Veldhuizen*et al*., 2006).
Ultee et al .,(2002) suggested that , the main charractesistics of essential oils is theirhydrophobiacity , which enables their incorporation into the cell membrane This activity may be due to the presence of phenolic monoterpene which has a hydroxyl group around the phenolic ring and exhibits into antifungal activity through the disruption of the cytoplasmic membrane .

Cristani*et al*., (2007), indicated that the hydrophilic part of the molecule interacts with the polar part of the membrane, while the hydrophobic benzene ring and the aliphatic side chains are in the hydrophobic inner part at the bacterial membrane, furthermore, the involvement of the hydroxyl group in the formation of hydrogen bonds and the acidity of these phenolic

compounds may have other possible explanations. Dafererа*et al.*, (2000), suggested that the fungitoxic activity of the essential oils may have been due to formation of hydrogen bonds between the hydroxyl group of oil phenolics and active sites of target enzymes. Lucini et al., (2006) indicated that mycelial growth inhibition is caused by the monoterpenes present in essential oils. These components would increase the concentration of lipidic peroxides such as hydroxyl, alkoxyl and alkoperoxyl radicals and so bring about cell death.

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معاملة بذور الفول السودانى بزيوت النعناع والقرنفل الاساسية للحد من الحمل الفطرى وإنتاج الأفلاتوكسين فى المحصول النهائى

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- تم استخدام زيوت نباتات النعناع والقرنفل كمضادات فطرية طبيعية قبل زراعة بذور فول سودانى ملوثة- معملياً بجراثيم فطر *A. flavus* المفرز للأفلاتوكسينات.
- تم استخدام ثلاثة أصناف من الفول السودانى فى الدراسة وهى جيزة 6 وإسماعيلية1 وجريجورى.
- أوضحت النتائج أن محصول الفول السودانى الناتج عن زراعة بذور ملوثة معاملة بزيوت النعناع والقرنفل لم يحتوى على أى مستويات من الأفلاتوكسينات مقارنة بالمحصول الناتج من زراعة بذور ملوثة معاملة بالمبيد الفطرى فيتافاكس والتى أعطت مستوى من الأفلاتوكسين قدر بـ 20 جزء بالبليون فى حالة محصول ناتج عن زراعة بذور جيزة 6 ، وأعطت مستوى 15 جزء فى البليون و في حالة محصول ناتج عن زراعة بذور إسماعلية1و8 جزء في البليون للصنف الجريجورجي .
- عند زراعة بذور جيزة 6 وإسماعيلية1 وجريجورى ملوثة وغير معاملة بأى معاملات قبل الزراعة أدى ذلك لتلوث المحصول الناتج بمستوى 37 جزء بالبليون ، 25 جزء بالبليون ، 22 جزء بالبليون على التوالى.
- كان أعلى مستوى للحمل الفطرى فى بذور المحصول الناتج عن زراعة بذور سودانى ملوثة وغير معاملة بأى معاملة حيث تراوحت قيمة العدد الفطرى الكلى من $15x10^4$ إلى $33x10^4$ خلية/جرام، بينما انخفض قيمة الحمل الفطرى فى بذور المحصول الناتج عن زراعة بذور سودانى ملوثة ومعاملة

بزيوت النعناع والقرنفل حيث تراوحت قيم العدد الفطرى الكلى من $7x10^2$ إلى $20x10^3$ خلية/جرام.

- أوضحت النتائج تواجد فطر *A. flavus* فى بذور المحصول الناتج من زراعة بذور ملوثة وغير معاملة بأى معاملات
- تم عمل تصنيف وعزل لأجناس الفطريات المتواجدة و كانت أكثر أجناس الفطريات الملوثة تواجداً هى الـــ *Rhizopus*spp. ، *Mucor spp.* ، *A.niger*، *Fusariumverricilliodis, Penicilliumaurantiogriscum, hirsutum, Alternaria alternate, Talaromycesmacrosporus*.
- كانت عينات قشور الفول السودانى كانت خالية من الأفلاتوكسينات ولكنها كانت ذات حمل فطرى عالى تراوح من $9x10^4$ الى $82x10^4$ خلية/جرام.
- تـم تقدير التغيـرات المورفولوجيـه وقياسـات المحصـول ونسـبة الزيـت بالمحصـول والتقيـيم مـن الناحيـة الزراعيه.
- اشـارت النتـائج ان العلاقـة كانـت معنويـه بـين الصـنف (ويشـمل جيـزة 6 واسـماعيليه 1 وجيريجـوري)و المعاملات التي اجريت علي البذور قبل زراعتها مثل المعامله بزيوت القرنفل والنعنـاع والمعاملـه بالمبيد الفطري (فيتافاكس) .
- تم تحليل عينات محصول الفول السوداني الناتج من زراعة البذور المعاملـه وذلك خـلال موسمين زراعـه متتاليان.
- اوضحت النتائج ان معامله بذور الفول السوداني من الصـنف جريجوري بزيت النعنـاع قبل الزراعـة و ادي الي انتاج افضل محصول مقارنة بباقي المعاملات خلال موسمي الزراعة.

بذور الفول السوداني من الصنف جيزه 6 المعامله بزيت القرنفل قبل الزراعة انتجت محصول يـاتي فـي المرحلة الثانيه من حيث الافضليه مقارنة بالمعاملة السابقه.

قام بتحكيم البحث

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Table (3): Performance of pods yield, seeds yield and shelling for peanut genotypes (combined data)

Characters / Treatments	Pod wiegh pl-1/g	Seed weight pl-1/g	Weight 100 pod /g	Weight of seeds from 100 pod/g	Shelling %	Pod weight /fed (Ardeb)	Seed Weight /fed (ardab)	Seed Weight /fed /kg	Oil %
Varieties (V)									
V1	41.5	30.6	172.6	114.0	65.84	14.21	12.92	990.9	44.6
V2	43.4	32.5	180.0	118.0	65.61	15.17	13.71	949.0	46.7
V3	48.7	37.0	188.0	123.0	65.63	17.25	15.63	1199.0	47.3
L.S.D at 5%	**3.1**	**2.1**	**6.5**	**4.6**	**2.27**	**1.45**	**0.88**	**201.6**	**1.4**
Treatment									
T1	41.8	30.4	163.3	104.0	63.71	14.39	12.83	985.4	45.9
T2	47.1	36.2	197.4	133.7	68.08	16.67	15.33	1036.0	47.6
T3	45.1	33.9	185.5	121.2	65.42	15.72	14.17	1097.0	46.2
T4	44.2	32.9	174.6	114.4	65.57	15.39	14.00	1067.0	45.3
L.S.D at 5%	**2.7**	**2.0**	**6.3**	**4.9**	**3.63**	**1.14**	**0.86**	**204.2**	**1.5**
interaction									
V1T1	39.6	29.5	151.0	93.64	62.02	13.50	12.50	961.7	43.3
V1T2	42.8	31.7	186.2	133.1	71.49	14.83	13.33	1028.0	46.5
V1T3	41.5	30.8	179.5	117.1	65.21	14.17	12.83	991.8	44.3
V1T4	40.8	30.1	173.9	112.3	64.64	14.33	13.00	982.1	44.4
V2T1	40.6	30.6	165.8	108.6	65.53	14.00	13.00	995.6	45.6
V2T2	45.3	34.8	196.7	129.9	66.30	16.00	14.67	715.2	47.9
V2T3	43.8	32.2	183.1	119.7	65.42	15.33	13.50	1049.0	47.8
V2T4	43.6	31.9	174.4	113.7	65.21	15.33	13.67	1036.0	45.6
V3T1	44.9	31.1	173.2	109.8	63.59	15.67	13.00	998.8	48.6
V3T2	53.2	42.1	209.3	138.2	66.45	19.17	18.00	1366.0	48.3
V3T3	49.7	38.4	194.0	126.8	65.62	17.67	16.17	1249.0	46.6
V3T4	46.8	36.5	175.4	117.2	66.87	16.50	15.33	1182.0	45.8
L.S.D at 5%	**4.7**	**3.5**	**10.84**	**8.63**	**6.29**	**1.97**	**1.48**	**353.7**	**2.5**

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