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# EFFECT OF STORAGE AND TEMPERATURE ON CERTAIN BIOLOGICAL ASPECTS OF *Calosobruchus maculatus* F. AND CHEMICAL COMPOSITION OF PEANUT SEEDS

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## ABSTRACT

Two varieties of peanut seeds (Giza 4 and Giza 5) were obtained from Agriculture Research Center at Giza. Seeds were used for rearing beetle of *Calosobruchus maculatus* F. and studying the effect of high temperature and storage for one year on certain biological aspects of *C. maculatus* and chemical composition of peanut seeds.

The obtained results revealed that: peanut seeds Giza 4 are more sensitive to be attacked by *C. maculatus* than Giza 5 variety, the tested peanut varieties had a highly significant effect on the developmental period and the adult beetles production, it was 27.58 $\pm$ 2.9, 30.60 $\pm$ 1.40 days for developmental period and total individuals production per female was 41.46 and 38.78 individuals for Giza 4 and Giza 5, respectively.

This beetle could be physically controlled by exposing the initially infested seeds to 60$^{o}$C for 5 minutes in the same time, chemical composition of heated peanut seeds slightly affected compared with control (unheated seeds).

Effect of storage time on total egg production of *C. maculatus* female, developmental period and chemical composition of stored peanut seeds was high significantly. Protein content had slight increase with increasing of storage time, developmental period of this beetle extended to decrease with increased temperature, it was 21.92 $\pm$ 0.74 at 30.7$^{o}$C when protein content was 23.62 %, fat 52.28%, Ash 3.23% and carbohydrate 20.87%.

On the other hand, storage caused decreasing in moisture and carbohydrate content of stored peanut seeds while fat and ash content were increased with increasing the time of storage. Essential amino acids were decreased as a result to increasing the time of storage and decreasing of developmental period this means increasing of insect population and degree of infestation. In addition, storage of peanut seeds caused decreasing in the percentage of total unsaturated, total essential fatty acids and iodine number while caused increasing in acid value, free fatty acids and peroxide value of peanut oil.

## INTRODUCTION

Peanut (*Arachis hypogaea* L.) is an important oil and food crop, it is the third major oil seed of the world next to soybean and cotton (FAO Food Outlook, 1990). The seed contains 25 to 32% protein and 42 to 52% oil. A pound of peanut is high in food energy and provides approximately the same energy value as 2 pounds of beef, 9 pints of milk, or 36 medium-size eggs (Woodroof, 1983). Peanut is usually stored in the form of unshelled nuts. Seven to eight months storage is usually required for peanut used as seed, and those intended for food uses can be stored until the start of next

harvesting season so, it is attacked by many insects at different stages of plant growth, various insects are naturally associated with seeds of crops during storage. Such insects are a major cause of deterioration of seeds and the cowpea beetle, *Callosobruchus maculatus* F. shows great variation in its biological trails on different hosts. Several workers have made attempts to identify and quantify such biological variations on different seeds to determine the crop resistance as a profitable control measure in reducing-post harvest seed losses (Yaday and Pant, 1978 and Credland 1986). The biology and control of this insect have been extensively studied by many authors; Howe and Currie, 1964; Dick; and Credland, 1986 and Mbata, 1993.

The present work carried out to study the effect of rearing on peanut seeds of the two varieties on certain biological aspects of *C. maculatus*. Also, studying the effect of high temperature on different stages of *C. maculatus* and the chemical composition of peanut seeds.

In addition, effect of storage time on the number of the eggs per female, developmental period of *C. maculatus* and its effect on chemical composition, amino acids and fatty acid contents of peanut seeds during one year of storage.

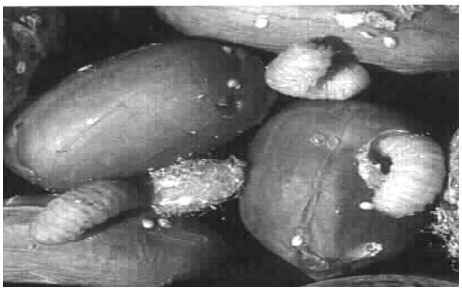
## MATERIALS AND METHODS

Seeds of two peanut varieties (Giza 4 and Giza 5) were obtained from the Agriculture Research Center at Giza. The samples were transferred to the laboratory of the Economic Entomology Department, Faculty of Agriculture at Kafr El-Sheikh, Tanta University.

1. **Effect of rearing *C. maculatus* on peanut seeds of two varieties on certain biological aspects:**

Seeds of two peanut varieties (Giza 4 and Giza 5) were used for rearing this beetle throughout one generation at constant conditions of 28$^{o}$C and 75% RH.

150 seeds of peanut were used for each tested variety. They were heated at 60oC to get ride of any previous infestation and were placed in 15 petri dishes each containing 10 seeds of each variety were examined daily. One newly emerged male and female were provided to every dish and the total eggs laid by each female, number of hatched ones and incubation period were recorded.



***C. maculatus* eggs and larvae, damaged seeds.**

On the other hand, larval period, pupal period, the mean developmental periods and the total beetles production per female were recorded. The moisture content of the media was kept in equilibrium with (75% RH) using KOH.Adults used in this experiments have been reared for several generations on the two varieties separately, before being used for seed infestation.

2. **Effect of high temperature on different stages of *C. maculatus* and chemical composition of peanut seeds:**

Four high temperatures 45, 50, 55 and 60$^{o}$C were tested for four exposure periods of 5, 10, 16, 20 minutes for each 20 infested Giza 4 seeds having all insect stages were taken from the insect stock culture. The seeds were put in glass jars and placed in an electrical oven running at each tested temperature degree continuously for the four tested periods of exposure under laboratory conditions. The treated seeds were inspected to determine the mortality percentage of each stage in addition to determination of its chemical composition.

3. **Effect of storage time on reproduction of *C. maculatus* and composition of peanut seeds under laboratory conditions during one year of 2000/2001:**

30 pairs of newly emerged males and females from the stock culture were used. One male was confined with one female in a plastic tube containing healthy seed of Giza 5 variety, the seeds were placed under laboratory conditions during one year, daily observation was conducted to record total eggs laid by each female and total developmental period. Also, gross chemical composition of healthy peanut seeds was determined every month and changes occurred in amino acids, fatty acids were determined every two months.

**Analytical methods:**

Moisture, crude protein, total lipids and ash contents were estimated every month as outlined by AOAC (1990). Carbohydrate was calculated by difference.

Amino acids were estimated by the method of Savoy *et al.* (1975). Fatty acids determination: The fatty acids methylesters of peanut samples were prepared and determined according to the method reported by Vogel (1975).

Iodine and peroxide values were determined according to the methods described by Leonard *et al.* (1987), acid value and free fatty acids (as oleic acid %) were determined according to the standard AOAC methods (1990). The previous analysis were estimated every two months.

## RESULTS AND DISCUSSION

**Some physical and chemical parameters of the two tested peanut seeds:**

Some physical and chemical parameters of the two tested peanut seeds (Giza 4 and Giza 5) are given in Table (1). The results show that seeds

of Giza 5 had oval shape while Giza 4 had elongated shape. Also, Giza 5 had weight of hundred seeds higher than that of Giza 4 (195.31 and 176.05 g, respectively). On the other hand Giza 5 was lower in fat content but higher in protein as compared to those of Giza 4 variety whereas fat content was 48.32 and 50.43% and protein content was 21.18 and 21.09% in Giza 5 and Giza 4, respectively.

These results agree with Rashwan *et al.* (1990) who found that total lipid content was 52.33 and 49.73% for peanut Kernels Giza 4 and Giza 5, respectively. Also, Woodroof (1983) found that peanut seeds contain 25 to 32% protein and 42 to 52% oil.

**Table (1): Some physical and chemical parameters of the two tested peanut varieties (Giza 4 and Giza 5).**

| Peanut varieties<br>Parameters | Giza (4) | Giza (5) |
|---|---|---|
| **Physical parameters:** | | |
| Seed shape | Elongated | Oval |
| Seed length (cm) | 1.9 | 1.2 |
| Weight of hundred seeds (g) | 176.05 | 195.31 |
| Pod length (cm) | 5.21 | 3.93 |
| **Chemical composition*:** | | |
| Moisture % | 7.68 | 7.85 |
| Protein % | 21.09 | 21.18 |
| Fat % | 50.43 | 48.32 |
| Ash % | 2.13 | 2.08 |
| Carbohydrate % | 26.35 | 28.42 |

***Chemical composition expressed on dry weight basis.**

**Effect of *C. maculatus* rearing on peanut seeds of the two tested varieties on certain biological aspects of the beetle:**

Seeds of the two peanut varieties (Giza 4 and Giza 5) were used for rearing this beetle throughout one generation at constant conditions of 28°C and 75% R.H. The effect of these tested varieties on certain biological aspects are given in Table (2) and can be discussed as follows:

- The mean number of eggs laid per female was high significantly influenced due to variations in peanut varieties and represented by 63.4 and 59.2 eggs/female on Giza 4 and Giza 5, respectively.
- Incubation period was insignificantly affected when the insect was reared on seeds of the two tested varieties, it was 6.13 $\pm$ 0.17 and 6.13 $\pm$ 0.82 days recorded with each of Giza 4 and Giza 5.
- The effect of variety of peanut on the larval and pupal periods appeared to be statistically significant. Larval period was 15.03 $\pm$ 0.39 and 17.21 $\pm$ 0.23 for Giza 4 and Giza 5 while pupal period was 6.42 $\pm$ 0.53 and 7.08 $\pm$ 0.64 for the two tested variety, respectively. Also, the tested peanut varieties had a significant effect on the developmental period, it was

27.58± 2.9, 30.60 ± 1.40 days for Giza 4 and Giza 5, respectively. The insect rate of reproduction measured a mean number of adults emerged per female was high significantly affected by peanut variety. Total beetle production per female 41.46, 38.78 individuals per female for Giza 4 and Giza 5, respectively.

**Table (2): Effect of rearing of *C. maculatus* on seeds of two peanut seeds varieties on certain biological aspects (in means) of the beetle at 28°C and 75% R.H.**

| Varieties / Biological aspects | Giza (4) | Giza (5) |
|---|---|---|
| Total egg production/F | 63.4 a | 59.2 b |
| Incubation period of eggs (in days) | 6.13 ± 0.17 a | 6.21 ± 0.82 a |
| Larval period (in days) | 15.03 ± 0.39 b | 17.21 ± 0.23 a |
| Pupal period (in days) | 6.42 ± 0.53 b | 7.08 ± 0.64 a |
| Mean developmental period (days) | 27.58 ± 2.9 b | 30.60 ± 1.40 a |
| Total beetle production/female | 41.46 b | 38.78 a |

The same results indicate that seeds of Giza 4 more sensitive to be attacked by *C. maculatus* beetles than those of Giza 5, it provides shorter developmental periods which in turn indicate greater suitability for insect development. Although seeds of Giza 5 are larger in size and higher in moisture, protein and carbohydrate than those of Giza 4 and the eggs laid on them were greater in number it was lower in its sensitivity than seeds of Giza 4, this means that seed sensitivity to beetle attack would not depend on number of laid eggs but on number of produced beetles as well as length of insect developmental period. Several investigation have been reported to clarify the relation between seed susceptibility to attack and the insect reproductive aspects. For example, Yaday and Pant (1978) and Mbata (1993) have reported that, generally short periods of insect development were found on susceptible varieties of seeds than bruchid-resistant ones.

Rashed *et al.* (1996) found that seeds of mung bean variety VC 1000 are more sensitive to attack by *C. chinesis* beetles than those of VC 2010, it provides shorter developmental period.

**Effect of high temperatures on different stages of *C. maculatus* and chemical composition of peanut seeds:**

The lethal effect of different high temperatures of 45, 50, 55 and 60°C on various stages of the cowpea beetle was investigated at different exposure periods of 5, 10, 15 and 20 minutes. The obtained results in Table (3) obviously indicate that there are highly significant effects for both temperature and exposure periods as well as their interaction on the mean mortality percentage of different stages.

Individuals of egg, larval, pupal and adult stages were similarly affected by the tested temperatures and exposure periods as mean mortality percentage was increased by increasing both aforementioned factors. The lowest mortality means of 8.4, 2.3, 3.1 and 9.7% were recorded when eggs,

larvae, pupae, adults were exposed to 45°C for 5 minutes respectively. But when temperature and exposure period increased above these levels, mortality percentage increased to reach the maximum of 100% at 45°C x 20 min., so as well 55°C x 10 min. and 60°C x 5 min. From these results it can be concluded that the cowpea beetle could be physically controlled if the infested seeds are exposed to 60°C for 5 minutes, therefore chemical composition of peanut seeds (Giza 5) was measured under this condition-whereas the results revealed that seeds treated with 60°C for 5 minutes were slight affected compared with control (untreated seeds). The same results show that moisture, protein, fat and ash percentages were 7.79, 21.16, 47.93 and 20.06%, respectively for the treated seeds while it was 7.85, 21.18, 48.32 and 2.08% for the same parameter, respectively in control as in Table (1). The use of fatal high temperature in order to achieve a successful physical control of the date stone beetle was reported by Hassanein *et al.* (2000).

**Table (3): Mean mortality percentage of different stages of *T. castaneum* exposed to high temperatures for different periods.**

| Parameter | Temp. °C | Exposure period (in minutes) | | | | |
|---|---|---|---|---|---|---|
| | | 5 | 10 | 15 | 20 | Average |
| Egg stage | 45 | 8.40 | 10.70 | 45.90 | 100.00 | 41.25 |
| | 50 | 45.20 | 73.80 | 100.00 | 100.00 | 79.75 |
| | 55 | 51.40 | 100.00 | 100.00 | 100.00 | 87.85 |
| | 60 | 100 | 100.00 | 100.00 | 100.00 | 95.75 |
| Average | | 51.2 $^{D}$ | 71.13 $^{b}$ | 86.98 $^{b}$ | 100.00$^{B}$ | |
| Larva stage | 45 | 2.3 | 11.6 | 43.8 | 100.0 | 39.43 |
| | 50 | 60.8 | 83.4 | 100.0 | 100.0 | 86.05 |
| | 55 | 81.3 | 100.0 | 100.0 | 100.0 | 95.33 |
| | 60 | 100 | 100.0 | 100.0 | 100.0 | 96.95 |
| Average | | 61.1 $^{e}$ | 79.75 $^{d}$ | 85.95 $^{c}$ | 100.0 $^{a}$ | |
| Pupal stage | 45 | 3.1 | 11.8 | 59.8 | 100.0 | 43.68 |
| | 50 | 43.8 | 90.7 | 100.0 | 100.0 | 83.63 |
| | 55 | 80.7 | 100.0 | 100.0 | 100.0 | 95.18 |
| | 60 | 100 | 100.0 | 100.0 | 100.0 | 96.30 |
| Average | | 56.91$^{e}$ | 65.63$^{D}$ | 89.95$^{c}$ | 100.0$^{a}$ | |
| Adult stage (male and female) | 45 | 9.7 | 25.4 | 75.0 | 100.0 | 52.53 |
| | 50 | 69.2 | 90.7 | 100.0 | 100.0 | 89.98 |
| | 55 | 90.8 | 100.0 | 100.0 | 100.0 | 97.70 |
| | 60 | 100 | 100.0 | 100.0 | 100.0 | 98.93 |
| Average | | 67.4$^{b}$ | 77.03$^{b}$ | 95.75$^{A}$ | 100.0$^{a}$ | |
| Chemical * composition | Moisture % | Protein % | Fat % | Ash % | Carbohydrate % | |
| | 7.79 | 21.16 | 47.93 | 2.06 | 28.85 | |

*** Chemical composition of peanut seeds treated with 60°C for 5 minutes.**

**Effect of storage time on reproduction of *C. maculatus* and chemical composition of stored peanut seeds:**

As shown in Table (4), the mean number of eggs laid per female was high significantly affected by both temperature and chemical composition. The

maximum and minimum number laid by any single female were 69.3 and 15.2 eggs at 30.2, 21.3°C and 4.22, 7.57% moisture content of stored seeds, non of eggs laid at 15.4 and 18.6°C. during Dec., January, Feb. and Mar. (Table 4). Also, temperature and moisture content of seeds had highly significant effects on the developmental period of this beetle tended to decrease with increased temperature and decreasing of moisture content. These period ranged from 21.92 ± 0.74 to 66.3 ± 0.45 at 30.7, 21.3°C and 4.10, 7.57% moisture content. In addition, data in the same table indicated that moisture and carbohydrate contents were decreased with increasing of storage time and temperature and the lowest values was 4.10 and 20.87%, respectively after 11 months while fat and ash contents were increased from 48.32, 2.08% to 52.28, 3.23%, respectively. On the other hand protein content had slight increase with increasing of storage time and the highest value was 20.62% after eleven months then begin to decline to reach 23.22% at the end of storage. These results agree with Rashwan *et al.* (1990) and nearly similar with those obtained by El-Refai and Ameddah (1988) who reported that total developmental period of *C. maculatus* decrease with increased temperature. Howe and Currie (1964) recorded that, female laid the highest mean number of eggs at 35°C and nearly as many at 30°C non of eggs laid at 15.0°C and few of those from 37.5°C. This indicate the effect of interaction between all data and this attributes to ecotypes of *C. maculatus* component of diet, interaction between temperature, RH. and handling technique.

**Table (4): Effect of storage time on number of egg per female, developmental period of *C. maculatus* and chemical composition of stored peanut seeds.**

| Month | Temp. °C | Egg/F | Developmental period (days) | * Chemical composition of peanut seeds | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Moisture % | Protein % | Fat % | Ash % | Carbohydrate % |
| 0 | - | - | - | 7.85 | 21.18 | 48.32 | 2.08 | 28.42 |
| Oct. | 22.7 | 43.2 | 36.05±1.48 | 7.76 | 22.83 | 48.26 | 2.32 | 26.59 |
| Nov. | 20.3 | 15.2 | 66.3±0.45 | 7.57 | 22.83 | 49.60 | 2.42 | 25.15 |
| Dec. | 15.4 | - | - | 6.36 | 22.87 | 50.39 | 2.57 | 24.17 |
| Jan. | 14.3 | - | - | 6.48 | 23.15 | 50.53 | 2.60 | 23.72 |
| Feb. | 16.2 | - | - | 5.21 | 23.19 | 50.59 | 2.64 | 23.58 |
| Mar. | 18.6 | - | - | 5.09 | 23.19 | 51.39 | 2.66 | 22.76 |
| Apr. | 22.6 | 18.4 | 55.72±0.36 | 5.02 | 23.32 | 51.42 | 2.72 | 22.54 |
| May | 25.5 | 39.0 | 39.15±0.07 | 4.95 | 23.39 | 51.44 | 2.72 | 22.45 |
| Jan. | 28.7 | 57.8 | 29.56±1.03 | 4.81 | 23.51 | 51.88 | 2.81 | 21.80 |
| July | 30.2 | 69.3* | 23.78±0.52 | 4.22 | 23.55 | 52.18 | 2.88 | 21.39 |
| Aug. | 30.7 | 55.8 | 21.92±0.74* | 4.10 | 23.62* | 52.28 | 3.23* | 20.87 |
| Sept. | 28.2 | 54.9 | 32.02±0.56 | 4.32 | 23.22 | 52.23 | 3.01 | 21.54 |

*** Chemical composition expressed as dry weight basis**
**** carbohydrate was calculated by difference.**

**Effect of storage on amino acids composition:**

Changes in amino acids composition of peanut seeds (Giza 5) during storage are given in Table (5). The present results indicate that the essential amino acids in peanut kernels was 49.48% and it was decreased with storage to reach 44.92% after 12 month. Phenylalanine, tyrosine and leucine were

predominant among the essential amino acids, where glutamic, asparatic and arginine were the highest within the non essential amino-acids. In addition, methionine and cystine were the limiting essential amino acids. On the other hand, storage of peanut kernels caused observed decreases in some non essential amino acids as well as essential amino acid. The total essential amino acids in peanut kernels protein are higher than those of soybean (44.4%) which reported by Kuri *et al.* (1991). On the other hand, the total essential amino acids in peanut kernels (49.48%) are much higher than that in faba bean protein (33.98%) and chickpea protein (35.57%) which reported by Salama (1999). This means that the protein in peanut kernels is higher quality compared with those in faba bean, chick pea and soybean.

These results are agree with Hassan *et al.* (1996) and was slightly higher compared with Mansour *et al.* (1995) the differences may be attributed to the different in variety.

**Table (5): Effect of storage time on amino acids composition of peanut seeds.**

| Storage time (month)<br>Amino acids content | 0 | 2 | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|
| **Essential amino acids:** | | | | | | | |
| Lysine | 4.63 | 4.61 | 4.51 | 4.56 | 4.48 | 4.36 | 4.30 |
| Methionine | 4.61 | 4.59 | 3.93 | 4.27 | 3.62 | 3.54 | 3.27 |
| Cystine | 0.49 | 0.48 | 0.22 | 0.33 | 0.18 | 0.16 | 0.16 |
| Threonine | 5.33 | 5.26 | 5.71 | 5.48 | 5.34 | 5.23 | 5.12 |
| Isoleucine | 5.97 | 5.95 | 5.90 | 5.95 | 5.77 | 5.72 | 5.61 |
| Leucine | 6.90 | 6.89 | 6.77 | 6.84 | 6.56 | 6.51 | 6.48 |
| Valine | 5.81 | 5.79 | 5.68 | 5.54 | 5.67 | 5.63 | 5.57 |
| Phenylalanine | 8.77 | 8.74 | 8.51 | 8.67 | 8.51 | 8.33 | 7.91 |
| Tyrosine | 6.97 | 6395 | 6.94 | 6.19 | 6.88 | 6.74 | 6.51 |
| Total | 49.48 | 49.26 | 48.17 | 47.83 | 46.96 | 46.22 | 44.92 |
| **Nonessential amino acids:** | | | | | | | |
| Alanine | 5.01 | 4.91 | 4.82 | 4.62 | 4.45 | 4.31 | 4.12 |
| Arginine | 11.83 | 12.36 | 12.94 | 12.95 | 11.75 | 11.72 | 10.62 |
| Asparatic | 12.73 | 12.71 | 13.43 | 13.73 | 13.62 | 13.48 | 13.32 |
| Glutamic | 26.11 | 26.62 | 25.51 | 25.09 | 24.74 | 23.43 | 24.20 |
| Glycine | 5.50 | 6.03 | 6.67 | 6.66 | 6.51 | 7.49 | 7.71 |
| Proline | 8.11 | 8.08 | 8.07 | 7.13 | 7.12 | 6.83 | 6.75 |
| Serine | 8.81 | 7.39 | 7.85 | 8.20 | 8.33 | 8.32 | 8.26 |
| Histidine | 6.44 | 5.84 | 5.67 | 5.70 | 5.66 | 5.58 | 8.49 |

**Effect of storage time on fatty acids contents:**

Results of gas chromatographic analysis of the methyl esters of saturated and unsaturated fatty acids of pea nut kernels during storage period are summarized in Table (6). The data indicated that unsaturated fatty acids were the major acids in peanut kernel whereas it was 80.02% of the total fatty acids in control (zero time) this finding show that the high nutritive value of peanut kernel lipids. In addition the obtained results of peanut kernel lipids showed that oleic acid is the major one (54.68%) followed by linoleic (23.62%) and palmitic (14.93%) acids and the main unsaturated fatty acids were oleic and linoleic followed by linolenic acid. On the other hand, palmitic and arachidic acids the most abundant saturated fatty acids. The same results

cleared that storage of peanut caused decreasing in the percentage of total unsaturated and total essential fatty acids especially after eight months and recorded the lowest values (73.09 and 23.32%, respectively) at the end of storage. In contrast, total saturated fatty acids increased by storage from 21.09% in control to 27.64% after 12 months. These results are in harmony with Raie and Ahmed (1981), and El-Sharkawy *et al.* (1986) who found that the fatty acids composition of peanut oil contained palmitic (13.84%), stearic (1.16%), oleic (52.88%) and linoleic (31.98%) also, Rashwan *et al.* (1990) found that total unsaturated and saturated fatty acids of peanut kernels were 85.97 and 13.18%, respectively.

**Table (6):** Effect of storage time on fatty acids content of peanut seeds.

| Storage time months / Fatty acids | 0 | 2 | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|
| Myristic (14: 0) | 0.14 | 0.19 | 0.31 | 0.37 | 0.54 | 0.52 | 0.47 |
| Palmitic (16: 0) | 14.93 | 14.76 | 14.21 | 14.33 | 15.12 | 15.89 | 16.87 |
| Stearic (18: 0) | 1.69 | 2.88 | 2.51 | 2.48 | 2.44 | 2.44 | 2.39 |
| Oleic (18: 1) | 54.68 | 53.69 | 53.86 | 52.46 | 49.83 | 49.81 | 49.77 |
| Linoleic (18: 2) | 23.62 | 23.61 | 23.56 | 22.57 | 21.92 | 21.91 | 21.89 |
| Linolenic (18: 3) | 1.72 | 1.69 | 1.64 | 1.52 | 1.46 | 1.44 | 1.43 |
| Arachidic (20: 0) | 2.61 | 1.40 | 2.23 | 2.99 | 3.97 | 3.95 | 3.96 |
| Behenic (22: 0) | 1.72 | 1.77 | 2.15 | 2.91 | 3.91 | 3.90 | 3.95 |
| Total unsaturated fatty acids | 80.02 | 78.99 | 79.05 | 76.55 | 73.21 | 73.16 | 73.09 |
| Total saturated fatty acids | 21.09 | 20.99 | 21.41 | 21.08 | 25.97 | 26.70 | 27.64 |
| Total essential fatty acids (EFA) | 25.34 | 25.30 | 25.19 | 24.09 | 23.38 | 23.35 | 23.32 |

**Effect of storage time on some physico-chemical constants of peanut oil:**

Results in Table (7) show the effect of storage on physico-chemical constants of peanut kernels oil, it could be noticed that storage decreased iodine value of peanut oil from 92.21 to 86.11 after 12 months of storage this decrease may be due to either peroxidation of unsaturated bonds, saturation or isomerization of unsaturated fatty acids (Varela *et al.,* 1982; Mostafa, 1987 and Rady *et al.,* 1987). While considerable changes were observed in the acid value and free fatty acids which increased with increasing the time of storage, this might be due to hydrolysis of oil during storage of peanut seeds i.e. the conversion of triglycerides into free fatty acids (FFA) and glycerol and the auto-catalytic effect of the resulting acids on the further hydrolysis of the oil (Omar *et al.,* 1990). In addition, peroxide value was increased especially after eight months of storage and recorded the highest value after 12 months, this increment due to formation of peroxide compound (Diaz, 1978 and Ashour *et al.,* 1986). Also, Gray (1978) reported that the primary products of lipid oxidation are hydroperoxides which are generally referred to as peroxides.

**Table (7): Effect of storage time on some physico-chemical constants of peanut oil.**

| Storage time months<br>Analysis | 0 | 2 | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|
| Iodine value (gl/100 g) | 92.21 | 91.78 | 91.84 | 90.61 | 87.70 | 87.66 | 86.11 |
| Acid value (mg KOH/g) | 0.82 | 1.06 | 1.53 | 1.53 | 1.86 | 2.30 | 3.12 |
| *Free fatty acids | 0.46 | 0.52 | 0.76 | 0.77 | 0.91 | 1.27 | 1.63 |
| peroxide value (meq/kg) | 2.65 | 2.68 | 2.71 | 2.94 | 3.16 | 3.36 | 3.51 |

*** As oliec acid %**

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## تـأثير التخـزين ودرجـة الحـرارة علـى بعـض الصـفات البيولوجيـة لحشـرة خنفسـاء اللوبيا والتركيب الكيماوى لبذور الفول السودانى

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**** قسم الصناعات الغذائية ـ كلية الزراعة بكفرالشيخ ـ جامعة طنطا**

تهدف هذه الدراسة إلى تقييم صنفين من الفول السوادنى تم الحصول عليهم من مركز البحوث الزراعية بالجيزة وهما جيزة ٤ ، جيزة ٥ واستخدمت البذور لدراسة مدى القابلية للإصابة بحشرة خنفساء اللوبيا وكذلك دراسة تأثير استخدام الحرارة العالية والتخزين لمدة عام على الأطوار المختلفة للحشرة وكذلك على التركيب الكيماوى لبذور الفول السودانى وقد أوضحت النتائج أن:

- بذور الفول السودانى من الصنف جيزة ٤ كانت أكثر حساسية للإصابة بالحشرة عن جيزة ٥.
- أيضا صنفى الفول السودانى المختبر أظهر تأثير معنوى على فترة النمو وإنتاج عدد من الافراد لهذه الحشرة حيث كانت فترة النمو ٢٧,٥٨ ± ٢,٩ و ٣,٦ ± ١,٤ يوم وكانت عدد الافراد الكلية الناتجة ٤١,٤٦ ، ٣٨,٧٨ لكل من جيزة ٤ ، جيزة ٥ الذى ثبت مقاومته اكثر للحشرة.
- تم التحكم طبيعيا فى الحشرة بتعريض البذور للحرارة ٦٠°م لمدة ٥ دقائق وفى نفس الوقت لم تؤثر هذه الدرجة على التركيب الكيماوى للبذور الا تأثير بسيط مقارنة بالكنترول.
- تأثير التخزين على إنتاج بيض الحشرة وكذلك فترة النمو والتركيب الكيماوى للبذور المخزنة كان معنوى.
- ازداد البروتين زيادة بسيطة مع زيادة فترة التخزين ودرجة الحرارة ونقص فترة النمو للحشرة التى تعنى زيادة عدد الأفراد الناتجة حيث كانت ٢١,٩٢ ± ٠,٧٤ على درجة ٣٠,٧°م حيث كان البروتين فى هذا الشهر من التخزين ٢٣,٦٢% وكان الدهن ٥٢,٢٨% ، الرماد ٣,٢٣% ، الكربوهيدرات ٢٠,٨٧%.
- من ناحية أخرى تسبب التخزين فى تناقص الرطوبة والكربوهيدرات للبذور المخزنة بينما ازداد كل من الدهن والرماد. تناقصت أيضا الأحماض الامينية الأساسية كنتيجة لزيادة مدة التخزين وتناقص فتره النمو للحشرة بالإضافة لذلك تسبب التخزين فى نقص نسبة الأحماض الدهنية الغير مشبعه والأساسية والرقم اليودى بينما ازداد رقم الحموضة والأحماض الدهنية الحرة ورقم البيروكسيد لزيت الفول السودانى المخزن.