

# ANATOMICAL FINGER PRINT AND BIOCONSTITUENTS AS SYSTEMATICAL TOOLS IN SOME DICOT. SEEDS

## 2- Chemical composition of seeds

by

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### ABSTRACT

The present thesis is devoted to investigate the chemical composition of some seeds of three different species, each include two varieties or cultivars, representing three genera and three families as follows:-

(From Malvaceae, cotton seed cvs. Giza 86 and Giza 66, Solanaceae, tomato seed vars. *Pyriforme* and *grandifolium* and Brassicaceae, rape seed cv. Pactal and var. *Tower*). The seeds under study even cultivars or varieties were obtained from The Seed Bank Of Flora and Phytotoxonomy Research Department (CAIM), Horticultural Research Institute (HRI), Agricultural Research Center (ARC). The aim of the present work was to clarity the importance and the significance of the seed chemical composition as criteria in taxonomic aspects. The different seed chemical composition of the studied taxa are presented in forms of cumulative tables and plates.

The general chemical analysis including lipid content, protein contents, total carbohydrates, mineral constituents, amino and fatty acids were determined in seed plant sample of the studied cultivars and varieties to facilitate the separation of the studied taxa, as well as, their use as criteria in taxonomic treatments.

It is quite clear that, different chemical compositions and their amounts could be considered as diagnostic features that make differentiation between the studied cultivars and varieties easier and more effective.

### INTRODUCTION

Plant taxonomy has drawn great attention of many scientists dealing with this scope of study. Different trends dealing with the basis of plant taxonomy, especially, those related to plant families.

That is why we find many researches dealing with the basis of taxonomy, especially, those based on the following characteristics:-

Chemical characters are of importance as all other taxonomic characters, they attain their value through correlation with other characters, and perfect correlation are the exception rather than the rule. Of all the sorts of chemical data, the structure of vital proteins may hold the most promise for helping to establish relationships among major groups of angiosperms. The chemical compounds that have been taxonomically the most useful up to

the present time are the secondary metabolites, perhaps simply because there are so many of them. The discovery and exploitation of major groups of new repellents may have played a decisive role in the origin and diversification of major groups of angiosperms, **Bisby *et al.*, (1980)**. Also plant chemistry provides new of information and the development of modern and simplified techniques make the application of chemical tests relatively easier.

The attractiveness of chemical characters is perhaps the possibility that in some cases the chemical evolution of a characters as taken place in a particular way and this kind of evidence may help in knowing of evolutionary relationship and taxonomic treatments **Nagaraj & Malik (1980)**.

The main objective of the present investigation is to throw light on the exomorphological, surface scan characters (Using light and scanning electron microscop) and micromorphological attributes, as well as, chemical composition of seeds of three species, included two cultivars or varieties for each specie (representing 3 families and 3 genera) under studies.

Thus, the present work is intended to apply morphological attributes, as well as, chemical composition to facilitate identification and separation of the studied taxa, as well as, studying their use as criteria in taxonomic treatments.

## MATERIALS AND METHODS

### 1. Plant materials:

In this work, seeds of three different species of three families [i.e., Malvaceae, Solanaceae and Cruciferae (Brassicaceae)] were taken as plant materials in this study. For each species; seeds of two economical varieties or cultivars were secured from Seed Bank Of The CAIM-Herbarium of Flora and Phytotaxonomy Department, Horticulture Research Institute (HIR), (ARC), Agricultural Museum, Dokki, Giza. The studied taxa belong to three genera namely: *Gossypium*, *Lycopersicon* and *Brassica* according to **Hutchinson's classification (1973)**. Table (1): The species under investigation showing the different families and genera according to **Hutchinson's (1973)**.

**Table (1): The different species taken as plant material in the present study.**

Family	Genera	Varieties or Cultivars
<b>Malvaceae</b>	<i>Gossypium</i>	<i>barbadense</i> L. cv. Giza 86
	<i>Gossypium</i>	<i>barbadense</i> L. cv. Giza 66
<b>Solanaceae</b>	<i>Lycopersicon</i>	<i>esculentum</i> L. var. Pyriforme
	<i>Lycopersicon</i>	<i>esculentum</i> L. var. Grandifolium
<b>Cruciferae (Brassicaceae)</b>	<i>Brassica</i>	<i>napus</i> L. cv. Pactol
	<i>Brassica</i>	<i>napus</i> L. var. Tower

## 2. Methods :

### - Chemical composition (Chemical analysis)

### - Extraction of oils from the seeds of different cultivars and varieties (defatting):

Seeds under investigation were cleaned, freed from foreign matter and milled into a small particles. The oils were extracted from the crushed seeds by the flowing method according to the standard method of **A.O.A.C. (1990)**.

The ground different cultivar seeds were soaked in pure n-hexane at 60°C, for 24h and then filtered. This process was repeated three times for 2 h by using fresh solvent each time. The collected micella in the process were filtered and distilled at 35°C using rotary evaporator. The crude oil was dried over anhydrous sodium sulphate and kept in dark bottle for further investigation.

### - Determination of fatty acids:

Methylation of the triglycerides content of the crude extracted oils was carried out by using methanolic-base (0.5 N) in iso-octane at room temperature as reported by **Daun et al. (1983)**.

The resulted methyl esters were transferred to disposable tube and the solution was neutralized with hydro-chloric acid and sodium carbonate. The methyl esters were separated by capillary gas chromatography on a bonded phase supelcowax<sup>-10</sup> (Polar) column. The methylated fatty acids samples were analyzed by GLC technique using Hewlett Packard Hp-5890-A. With flame ionization detector (FID) supplied with integrator and computer control under the following conditions:

- 1- Column: supelcowax<sup>-10</sup> 15M length, 0.32 mm inside diameters 0.25µm film thickness, contain polyethylene glycol.
- 2- Column temperature and pressure: 1 min. at 210°C, then to 240°C at 10°C/min. and hold 1 min. column head pressure 32 Kpa (4.75 psi).
- 3- Carrier gas linear velocity: 52 cm/sec., Helium at 210°C and flow rate 18 ml/min.
- 4- Injection port temperature: 250°C, auto injection and Detector Temperature: 250°C.

Standard methyl esters of the fatty acids were used for identification of the unknown fatty acids.

### - Total nitrogen and crude protein:

Total nitrogen was determined in the dry defatted matter of the different cultivars by using wet digestion according to **Piper (1947)**, by using micro-kjeldahl as described by **Horneck and Miller (1998)**, then calculated as percentages. The crude protein was calculated according to the following equation:

$$\text{Crude protein} = \text{total nitrogen} \times 6.25.$$

Except in cotton seed was calculated as,

$$\text{Crude protein} = \text{total nitrogen} \times 5.30. \text{ (A.O.A.C., 1990).}$$

**- Minerals constituent :**

**- Phosphorus:**

It was determined colorimetrically according to the method of **Sandell (1950)** and then calculated as percentages.

**- Potassium and sodium content:** were determined by the flame photometer Model Carl-Zeiss according to the method described by **Horneck and Hanson (1998)**, and calculated as percentages.

**- Calcium and magnesium:** were determined by using versenate method according to **Richard (1954)**, and calculated as percentages.

**- Copper, iron, manganese and zinc:** were determined according to the method described by **Rowe (1973)** by using Pye Unicam Atomic Absorption Spectrophotometry Sp 457, and calculated as percentages.

**- Total carbohydrates:**

Total sugars were determined as glucose (unless otherwise specified), by the phenol-sulfuric acid method (**Dubois et al., 1956**) in a properly diluted solution of the analyzed sample. A known weight of the sample was mixed with 10 ml ice-cold H<sub>2</sub>SO<sub>4</sub> (grade 95.5%, 80% w/v) and the mixture kept at room temperature for 4h. The volume was made up to 250 ml in a volumetric flask with distilled water. To one ml of 5% phenol solution was added, then 5 ml of conc. H<sub>2</sub>SO<sub>4</sub> were added rapidly. The mixture was shaken and set aside for 10 min. at room temperature then at 25-30°C in a water bath for 20 min. thereafter the color density was measured at a suitable wave length of 490 nm for hexoses and 480 nm for pentoses and uronic acids using Pye unicam Sp6-550 uv/VIS spectrophotometer. A blank experiment was carried out under the same conditions.

**- Determination of total amino acid compositions:**

The seeds of all varieties were hydrolyzed using 6N HCl at 110°C for 24 hrs in an evacuated ampoules.

Quantitative determination of amino acids was carried out according to **Moore et al., (1958)**, using high performance amino acid analyzer, Model Beckman, System 7300 and data system 7000, Column Na-A/B/D 25-cm column and sample volume 50µl.

## **RESULTS AND DISCUSSION**

Seeds of angiosperms most often have food reserves consisting largely of secondary metabolites which are the chemical compounds that have been taxonomically considered the most useful items-up till now- perhaps simply this is due to the presence of because so many of them. They form a great horde of chemically unrelated substances that do not appear to be necessary for ordinary metabolic functions. They include such diverse compounds as amino acids, fatty acids, carbohydrates,

tannins, poly-acetylenes, flavonoids....etc. Each kind of secondary metabolite, and each set set of, occurs in some quantity in alimited array of plant taxa, and is wanting (or nearly so) from others. The distribution is not at all random, but shows varying degrees of correlation with groups recognized on other bases. We don't know of any perfect correlations occur at all levels up to and including the two classes (monocots and dicots).

Like other chemical features, secondary metabolities have had their greatest acceptance as taxonomic characters when they have been used in conjunction with other characters as part of a comprehensive re-evaluation. Taxonomy depends on multiple correlations, and we want assure that any new scheme shows a better set of correlations and fewer anomalies than the one it replaces. In this respect, the present work is intended to apply chemical compositions to facilitate the separation of the studied taxa, as well as, their use as criteria in taxonomic treatments as follows:-

The general chemical analysis including lipid content, protein contents and total carbohydrates were determined in seed plant sample of cotton seeds (2 cultivars), tomato (2 varieties) and rape (1 cultivar and 1 variety) are presented in **Table (1)**.

#### **- Chemical composition of cotton cultivars:-**

Two samples of whole cotton seed, were analyzed for chemical composition. The results are shown in **Table (2)**.

#### **-Lipid content:-**

Lipid contents of cotton cultivars (**Table,2**) ranged from 17.50% (Giza 66 cultivar) and 25.35% (Giza 86 cultivar). The present results are in agreement with those obtained by **Pondey and Thejappa (1977) and Galal (1997)**.

#### **-Crude protein contents:**

Results of crude protein contents of cotton samples (**Table,2**) show that Giza 86 cultivar contains 34.63%, while Giza 66 cultivar contains 29.50%. These results are slightly lower than those reported by **Pondey and Thejappa (1977)**.

The obtained data disagreed with those reported by **Abu-Foul et al., (1992), Zein El-Dein (2000)**.

#### **-Total carbohydrates:-**

Total carbohydrates in cotton cultivars (**Table,2**) ranged from 37.83% (Giza 86) to 54.08% (Giza 66) these results are in agreement with those obtained by **Pondey and Thejappa (1977) and El-Sayed (1987)**.

### **- Chemical composition of tomato varieties:-**

Two samples of whole tomato seed, were analyzed for chemical composition. The results are shown in **Table (2)**.

The obtained results are showed the chemical composition of both tomato seed varieties and their meals. It could be noticed that:-

#### **-Lipid content:-**

In general the data reported in **Table (2)** show that lipid contents of tomato varieties were 20.35% (*Pyriforme* variety) and 26.30% (*grandifolium* variety).

The data are in well agreement with those mentiond by **Moharram & Messalam (1980)** and **Attia et al., (2000)** while slightly differed from that reported by **Tsatsaranis and Boskou (1975)**.

#### **-Crude protein content:-**

The total protein content which comprises the most important nutritional ingredient of the meal ranged from 27.67% (*pyriforme* variety) to 33.33% (*grandifolium* variety).

These results go with those reported by **Moharram et al., (1984)** and **Lazos and Kalathenos (1988)**.

#### **-Total carbohydrates:**

Results in **Table (2)**, indicte that the total carbohydrates in tomato seed varieties ranged from 22.75% (*grandifolium* var.) to 25.21% (*pyriforme* var.)

These results are within the range of those obtained by **Lazos and Kalathenos (1988)** and **Atlia et al. (2000)**.

### **- Chemical composition of rape seed cv. Pactol and var. Tower:-**

#### **-Lipid content:-**

Lipid contents of rape seed (**Table,2**) ranged from 34.31% (cv. Pactol) to 41.95% (var. *Tower*). The obtained results slightly differed from those obtained by **El-Nockrashy et al., (1977)**, **Bell and Shires (1983)**, **Farag et al., (1986)**, **Marianchuk et al., (1987)**, **Mills et al., (1987)** and **Declereq et al., (1992)**.

#### **-Crude protein contents:**

Results of crude protein contents of rape samples (**Table,2**) show that tower variety contains 29.83%, while cv. Pactol contains 25.33% which as lower than our obtained results that are similar to those reported by **Ahmed (2004)**.

### **-Total carbohydrates:-**

Total carbohydrates in rape seeds (**Table,2**) ranged from 16.81% (var. *Tower*) to 26.36% (cv. *Pactol*). These results agree with those obtained by **Declereq et al., (1992)** and **El-Samanody (1998)**, while these results disagreed with those reported by **Ahmed (2004)**.

These variations may be due to the variety of seeds, climatic conditions, agricultural conditions and the methods used for determination.

The previous results indicated that seeds of angiosperms mostly have food reserves consisting largely of oil or fat, carbohydrates, and commonly some proteins as well. Differences in the quantity of these proximate chemical compositions frequently have strong taxonomic correlation and of good features that make the separation between the studied species being easier.

### **- Mineral constituents:-**

#### **- Mineral constituent of cotton seed cultivars:-**

The ashes of different cotton seed cultivars were analyzed to show some of their mineral content. These results are presented in **Table (3)**. The determined minerals included Na, K, P, Ca, Mg, Cu, Fe, Mn and Zn with values 0.023, 1.73, 1.62, 0.03, 0.026, 0.017, 0.024, 0.016 and 0.010%, respectively For cotton seed cv. Giza 86 meanwhile, in case of Giza 66 values were 0.025, 1.15, 1.30, 0.20, 0.15, 0.0097, 0.098, 0.020, and 0.009% respectively for cv. Giza 66.

These results represent that cv. Giza 86 are relatively high in its content of K, P, Mg, Zn and Cu. While cv. Giza 66 contains high percentage amount of Na, Ca, Mn and Fe. These results are almost in agreement with those reached by **Weber and Neumann (1980)** and **Abu-Foul et al., (1992)**. Such differences might be attributed to the different varieties.

#### **- Minerals constituent of tomato seed varieties:-**

Data in **Table (3)** indicate that mineral constituents of tomato seed ash as K, Ca, Mg, P, Cu, Fe, Zn, Na and Mn their values 0.94, 0.103, 0.472, 1.42, 0.017, 0.106, 0.0085, 0.012, and 0.037%, respectively for *pyriforme* variety. Meanwhile, their percentages in the *grandifolium* variety were 1.36, 0.076, 0.306, 1.34, 0.016, 0.167, 0.0106, 0.014. and 0.019%, respectively. These results are in agreement with those reported by **Shams El-Din and Madiha (1997)** and slightly differed from these reported by **Moussa (1990)**.

The variations may be due to the variety of seeds. Also, it can be noticed that the major minerals in both varieties of seeds are K, Ca, Mg, P and Fe. While the other minerals are found in low quantities are (Cu, Zn, Na and Mn).

#### **- Mineral constituent of rape seed (cv. Pactol and var. Tower):**

The mineral content of rape seed meal samples are presented in **Table (3)** which showed that var. *Tower* and cv. *Pactol* samples were relatively rich in P, K, Ca, Mg and Na. However, Fe and Zn were present in moderate values, while Cu and Mn contents were found in relatively trace amounts. Such values were similar to those reported by **Shabana *et al.*, (1990) and El-Samanody (1998)**.

Finally, from the previous mentioned results of mineral constituent of the seeds of the studied cultivars and varieties, it is quite clear that, different mineral elements are accumulated by some kinds of plants in quantities greater than those usually required for ordinary metabolism, these minerals have attracted more than minimal taxonomic attention, because these have a direct morphological expression that has already been considered in classical taxonomy and is considered as diagnostic features that make the differentiation between the studied cultivars and varieties easier and more effective.

#### **- Amino acid composition:-**

Seeds of angiosperms mostly have food reserves consisting largely of protein. Differences in the kind of amino acids and their amounts making up the proteins frequently have a strong taxonomic correlation, **Bisby, *et al.* (1980)**. Also it is considered as good diagnostic feature that makes the differentiation and separation between the studied cultivars and varieties easier and more effective.

#### **- Amino acid composition of cotton seed cultivars:-**

The data of the amino acids composition of cotton seed cultivars (**Table,4**), clearly indicate that E.A.A. of cotton seed meal (cv. Giza 86) Lys., Leu., Iso-Leu., Cys., Met., Phe., Tyr., Thr., Val. and Try. were 3.80, 7.10, 4.43, 1.60, 2.70, 4.20, 4.23, 2.80, 5.60 and 2.15 g/100g protein, respectively, while non E.A.A. His., Arg., Asp., Glu., Ser., Pro., Gly. and Ala. were 3.45, 7.76, 9.12, 19.43, 5.43, 3.20, 6.78 and 5.36 as g/100g protein, respectively.

On the other hand, the essential amino acids composition of cotton seed (cv. Giza 66) were Lys. (3.85), Leu. (8.35), Iso-Leu. (4.63), Cys. (0.65), Met. (1.92), Phe. (5.49), Tyr. (5.06), Thr. (3.57), Val. (4.84) and Try. (0.78) g/100 protein, while nonessential amino acids were His (2.33), Arg. (8.07), Asp. (8.90), Glu. (21.65), Ser. (4.93), Pro. (5.09), Gly. (5.60) and Ala. (4.59) g/100 g protein, respectively.

The results indicated that both cotton seed cultivars relatively high levels of (Glu.), (Asp.), (Arg.), (Leu.) and (Gly.) and contain low values of (Ala.), (Pro.), (Ser.), (Val.), (Phe.) and (Tyr.) while, the content of there amino acids were nearly the same in both cultivars. These results are relatively in agreement with those obtained by **Ali (1987)**.

From the previous results, it could be clearly noticed that there were large differences in the amounts of amino acids found in the investigated cultivars.



These differences could support and help in the study of taxa delimitation and may solve or facilitate many of taxonomical classification problems.

#### **- Amino acids composition of tomato seed varieties:-**

Data concerning the amino acids composition of tomato seed varieties in that are showed **Table (4)** indicate that Isoleu. (4.01), Leu. (4.96), Lys. (7.10), Phe. (3.54), Tyr. (2.67), Cys. (0.49), Met. (1.45), Thr. (4.35) Try. (1.91), Val. (2.53), His. (12.25), Arg. (13.40), Asp. (21.05), Glu. (5.80), Ser. (4.65), Gly. (5.70) and Ala. (3.80) in *pyriforme* variety. On the other hand, the amino acid values were 4.70, 9.30, 6.90, 5.91, 2.41, 0.25, 0.64, 0.84, 1.06, 5.90, 2.50, 7.70, 16.87, 13.29, 1.70, 6.60 and 4.15 g/100 g protein, respectively in var. *grandifolium*. These results are in agreement with those reported by **Moussa (1990)**. From the previous results it could be concluded that in general glutamic, asparatic and argnine acids are the most abundant amino acids in *pyriforme* variety, followed by lysine, Glycine, Leucine, Proline and isoleucine. Cysline is present in minute quantity with a value of 0.49 g/100 g protein. On the other hand, Asparatic, Glutamic, Serine and leucine acids are the most abundant amino acids in the *grandifolium* variety, followed by argnine, lysine, Glycine, phenylalanine and valine. While, cystine, methionine and threonine are present in small quantities with values of 0.25, 0.64 and 0.84 g/100 g protein, respectively.

The obtained data also indicate that there were great differences in the amounts of amino acids in the investigated varieties. These differences give a good trial to clarify the differentiation, similarities, interrelationships and characterization among the studied varieties.

#### **- Amino acids composition of rape seed (cv. Pactol and var. Tower):-**

The data of the amino acids composition of rape seed (cv. Pactol and var Tower) in **Table( 4)**, clearly indicate that glutamic, aspartic and argnine acids are the most abundant amino acids followed by leucine in both rapeseed varieties.

Cystine is present in very small quantities in both varieties with average ranged from 1.2 (cv. Pactol) to 1.5 (var. *Tower*) g/ 100g protein.

The reported data for the relative amino acid composition of rapeseed varieties agreed with those reported by **Tzeng et al., (1988)** and differed from those reported by **Barbour and Sim (1991)**, **Zuprizal et al., (1993)**, **Hafermann et al., (1993)** and **El- Samanody (1998)**.

The variations may be due to the variety of seeds, climatic conditions and the applied methods. Differences in the amounts of amino acids could be a major significant diagnostic. That may be attributes to clear separation of taxonomic units, especially at the specific level.

### - Fatty acids composition:-

### - Fatty acids composition of cotton seed cultivars:-

Authentically pure samples of fatty acid methyl esters were examined under the same set of reaction, as indicated in the experimental section. GLC analysis of the individual fatty acids of the two cultivars of cotton seeds under investigation are presented in **Table (5)** and illustrated in **Figure (1)**.

The predominant saturated fatty acid was palmitic acid (C16:0). Its amount ranged from 23.837% (cv. Giza 86) to 26.351% (cv. Giza66).

Similar values were reported by **Mahmoud (1995)**. Steric acid (C18:0), was found in amounts ranged from 0.858% (cv. Giza bb) to 3.116% (cv. Giza 86), while other saturated fatty acids e.g., lauric acid (C12:0), myristic acid (C14:0), arachidic acid (C20:0) and behenic acid (C22:0) were found in low amounts. These results are in agreement with those reported by **Badami et al ., (1978) and Zeitoun et al. (1991)**.

Also the obtained results show that the major constituents of unsaturated fatty acids in oils extracted from cotton seed cultivars were C18:1, C18:2 and C<sub>18:3</sub>. It is clear that linoleic acid (C<sub>18:2</sub>) was the most prevalent unsaturated fatty acid that ranged from 35.947% (cv. Giza 86) to 36.393% (cv. Giza 66). Oleic acid (C<sub>18:1</sub>) was the second major unsaturated acid, its content ranged from 26.427% (cv. Giza 86) to 33.242% (cv. Giza 66). Linolenic acid (C<sub>18:3</sub>) was the third major unsaturated fatty acid, its amount ranged from 1.421% (cv. Giza 66) to 7.715%(cv. Giza 86).

Concerning the palmitoleic acid (C<sub>16:1</sub>) content, the obtained results show that cv. Giza 86 contains 0.971% of palmitoleic acid.

On the other hand, palmitoleic acid (C<sub>16:1</sub>) was not detected in the oil of cv. Giza 66. These results are almost in agreement with those found by **FAO/WHO (1977) and El-Sadik (1999)**.

From the previous mentioned results, we can notice that the fatty acid analysis is very important to differentiate and separate between the two studied cotton seed cultivars.

### - Fatty acids composition of tomato seed varieties:-

Two varieties of tomato seed were considered in this investigation for fatty acids analysis. Data in **Table (5) and figure (2)** show that the major constituents of unsaturated fatty acids were C<sub>18:1</sub>, C<sub>18:2</sub>, C<sub>18:3</sub> and C<sub>22:1</sub>. It is clear that Linoleic acid, was the most prevalent unsaturated fatty acid ranged from 42.538% (var. *pyriforme*) to 54.287% (var. *grandifolium*) Followed by oleic acid that ranged from 23.723% (var. *grandifolium*) to 36.618% (var. *pyriforme*), then limoenic acid which ranged from 2.180% (var. *grandifolium*) to 2.97% (var. *pyriforme*).

Concerning the erucic acid contents, the data show that, *grandifolium* var. contains a little amount of erucic acid (1.825%) while, *pyriforme* var. contains 2.652%.

Palmitic acid was the predominant saturated fatty acid in the two varieties. Its amount that ranged from 11.578% (var. *pyriforme*) to 12.784% (var. *grandifolium*), followed by stearic acid ranged from 2.967% (var. *pyriforme*) to 4.704% (var. *grandifolium*).

Concerning the myristic acid contents, the obtained results show that *pyriforme* and *grandifolium* have traces (< 1 %) of myristic acid while the same varieties contain a very small amount of arachidic acid 0.493, 0.456% respectively.

These results are in agreement with those reported by **Kamel *et al.* , (1982) & Shams – El-Din and Madiha (1997)** but differed from those reported by **Moussa (1990) and Galal (1992)**.

These variations could be due to the variety of seeds. From the previous mentioned results we can notice that the variation of fatty acids percentages is considered a good diagnostic character that makes the differentiation and separation between the studied varieties easier and more effective.

#### **- Fatty acids composition of rape seed (cv. Pactol and var. Tower):-**

The fatty acids composition of rape seed oil for (cv. Pactol and var. *Tower*) were analyzed by GLC **Table (5) and figure (3)**.

The GLC of the methyl esters of rape seed fatty acid show that the predominant saturated fatty acid was palmitic acid (C<sub>16:0</sub>). Its amount ranged from 5.64% (cv. Pactol) to 6.824% (var. *Tower*).

Similar values were found by **El-Samanody (1998) and Ahmed (2004)**. stearic acid (C<sub>18:0</sub>) was found in amounts ranged from 1.359% (var. *Tower*) to 1.451% (cv. Pactol) while, other saturated fatty acids e.g., arachidic acid (C<sub>20:0</sub>) were found in low amounts. On the other hand, myristic acid (C<sub>14:0</sub>) was not detected in the oil under investigation. These results are in agreement with those reported by **Mahmoud (1995), El-Samanody (1998) and Ahmed (2004)**.

The obtained results show that the major constituents of unsaturated fatty acids in oils extracted from rape seed varieties were C18:2 , C18:2 , C18:3 and C22:1. It is clear that oleic acid (C18:1) was the most prevalent unsaturated fatty acid that ranged from 21.864% (cv. Pactol) to 32.773% (var. *Tower*). Linolenic acid (C18:3) was the second in order major unsaturated acids, its content ranged from 10.066% (var. *Tower*) to 30.479% (cv. Pactol). Linoleic acid (C18:2) was the third major unsaturated fatty acid, its content ranged from 26.424% (cv. Pactol) to 27.673% (var. *Tower*). These results are in agreement with those reported by **El-Samanody (1998)**. Concerning the erucic acid content (C22:1), the obtained data show that var. *Tower* contains the higher amount of erucic acid 20.593% than cv. Pactol which contains 13.591%. It is quite clear from the previous mentioned data that rapeseed oils of different varieties under investigation contained appreciable quantities of fatty acids with chain lengths greater than the usual eighteen carbon atoms, and significant amounts of polyunsaturated acids were also present. A clear linear relationship between linolenic and erucic acid may originate in the seed oil of the studied varieties. In other words, a high linolenic acid content in

cv. Pactol o.e. 30.479% was accompanied by a low erucic acid (13.591%). While, var. *Tower* exhibited high erucic acid Its contents 20.593% of erucic acid accompanied with a low level of linolenic acid (C18:3) reached to 10.066%. Obviously , the elongation of linolenic acid to erucic acid was the main pathway of biosynthesis of the latter acid. This deduction agrees with those reported by **Jonsson(1977)** who suggested that the addition of two carbon atoms to the carboxyl group of linolenic from eicosenoic acid, followed by second addition of another two carbon forming erucic acid.

It is quite clear from the previous data that differences in the kind of fatty acids making up the fats or oils, frequently, have a strong taxonomic correlation, as does the introduction of starch or hemicellulose as major storage product. Also it is noted that erucic acid is a major characteristic component of the seed fats of the Brassicaceae, and appears to be of very limited occurrence outside papaverales.

**Table (2): Chemical composition of seeds of the cultivars and varieties under study.**

<b>Species</b>	<b>Chemical composition</b>	<b>Oil (%)</b>	<b>Crude protein (%)</b>	<b>Total carbohydrates (%)</b>
<i>Gossypium barbadense</i> L. cv. Giza 86		25.35	34.63	37.83
<i>Gossypium barbadense</i> L. cv. Giza 66		17.50	29.50	54.08
<i>Lycopersicon esculentum</i> L. var. Pyriforme		20.35	27.67	25.21
<i>Lycopersicon esculentum</i> L. var. grandifolium		26.30	33.33	22.75
<i>Brassica napus</i> L. cv. Pactol		34.31	25.33	26.36
<i>Brassica napus</i> L. var. Tower		41.59	29.83	16.81

**Table (3): Seeds minerals constituent of the of the studied cultivars and varieties.**

<b>Species</b>	<b>Elements g%</b>								
	<b>K</b>	<b>P</b>	<b>Ca</b>	<b>Mg</b>	<b>Na</b>	<b>Fe</b>	<b>Cu</b>	<b>Mn</b>	<b>Zn</b>
<i>Gossypium barbadense</i> L. cv. Giza 86	1.73	1.62	0.03	0.26	0.023	0.024	0.017	0.016	0.010
<i>Gossypium barbadense</i> L. cv. Giza 66	1.15	1.30	0.20	0.15	0.025	0.098	0.0097	0.020	0.009
<i>Lycopersicon esculentum</i> L. var. Pyriforme	0.94	1.42	0.103	0.472	0.012	0.106	0.017	0.037	0.0085
<i>Lycopersicon esculentum</i> L. var. grandifolium	1.36	1.34	0.076	0.306	0.014	0.167	0.016	0.019	0.106
<i>Brassica napus</i> L. cv. Pactol	1.90	1.53	0.80	1.08	0.018	0.126	0.013	0.078	0.011
<i>Brassica napus</i> L. var. Tower	2.28	1.54	0.10	1.92	0.025	0.122	0.018	0.024	0.0077

**Table (4): Amino acids composition of the cultivars and varieties under study.**

Varieties Amino acids g/100g protein	<i>Gossypium barbadense</i> L cv. Giza 86	<i>Gossypium barbadense</i> L. cv. Giza 66	<i>Lycopersicon esculentum</i> L. var. <i>Pyriforme</i>	<i>Lycopersicon esculentum</i> L. var. <i>grandifolium</i>	<i>Brassica napus</i> L. cv. Pactol	<i>Brassica napus</i> L. var. <i>Tower</i>
<b>Essential amino acids</b>						
Lysine (Lys.)	3.80	3.85	7.10	6.90	3.51	3.90
Leucine ( Leu.)	7.10	8.35	4.96	9.30	7.32	7.50
Iso-Leucine. (Iso-Leu.)	4.43	4.63	4.01	4.70	4.38	4.20
Cystine (Cys.)	1.60	0.65	0.49	0.25	1.20	1.50
Methionine (Met.)	2.70	1.92	1.45	0.64	2.27	2.34
Phenylalanine (Phe.)	4.20	5.49	3.54	5.91	4.97	4.80
Tyrosine (Tyr.)	4.23	5.06	2.67	2.41	1.42	1.44
Threonine (Thr.)	2.80	3.57	4.35	0.84	3.50	3.65
Valine (Val.)	5.60	4.84	1.91	5.90	4.23	4.76
Tryptophane (Try.)	2.15	0.78	1.07	1.06	3.20	3.30
<b>None essential amino acids</b>						
Histidine ( His.)	3.45	2.33	2.53	2.50	2.50	2.70
Arginine ( Arg.)	7.76	8.07	12.25	7.70	8.10	8.10
Asparatic acid ( Asp.)	9.12	8.90	13.40	16.87	7.90	8.30
Glutamic acid ( Glu.)	19.43	21.65	21.05	13.29	19.80	19.50
Serine ( Ser.)	5.43	4.93	5.80	9.52	4.30	4.40
Proline ( Pro.)	3.20	5.09	4.65	1.70	4.80	4.70
Glycine ( Gly.)	6.78	5.60	5.70	6.60	5.30	5.40
Alanine ( Ala.)	5.36	4.59	3.80	4.15	4.20	4.40

**Table (5): Fatty acids composition of the cultivars and varieties under study.**

R. T.	Fatty acid		<i>Gossypium barbadense</i> L. cv. Giza 86	<i>Gossypium barbadense</i> L. cv. Giza 66	R. T.	Fatty acid		<i>Lycopersicon esculentum</i> L. var. Pyriforme	<i>Lycopersicon esculentum</i> L. var. grandifolium	R. T.	Fatty acid		<i>Brassica napus</i> L. cv. Pactol	<i>Brassica napus</i> L. var. Tower
			Area %	Area %				Area %	Area %				Area %	Area %
2.77	C <sub>12:0</sub>	Lauric acid	0.083	0.084	4.31	C <sub>14:0</sub>	Myristic acid	0.167	0.045	10.03	C <sub>16:0</sub>	Palmitic acid	5.640	6.824
5.14	C <sub>14:0</sub>	Myristic acid	0.790	0.87	10.16	C <sub>16:0</sub>	Palmitic acid	11.578	12.784	19.63	C <sub>18:0</sub>	Stearic acid	1.451	1.359
10.20	C <sub>16:0</sub>	Palmitic acid	23.837	26.351	20.10	C <sub>18:0</sub>	Stearic acid	2.967	4.704	21.68	C <sub>18:1</sub>	Oleic acid	21.864	32.773
11.31	C <sub>16:1</sub>	Palmitoleic acid	0.971	N.D.	22.12	C <sub>18:1</sub>	Oleic acid	36.618	23.723	26.28	C <sub>18:2</sub>	Linoleic acid	26.424	27.673
19.79	C <sub>18:0</sub>	Stearic acid	3.116	0.858	26.82	C <sub>18:2</sub>	Linoleic acid	42.538	54.287	33.03	C <sub>18:3</sub>	Linolenic acid	30.479	10.066
21.97	C <sub>18:1</sub>	Oleic acid	26.427	33.242	33.07	C <sub>18:3</sub>	Linolenic acid	2.970	2.180	38.32	C <sub>20:0</sub>	Arachidic acid	0.527	0.684
26.79	C <sub>18:2</sub>	Linoleic acid	35.947	36.393	38.72	C <sub>20:0</sub>	Arachidic acid	0.493	0.456					
33.13	C <sub>18:3</sub>	Linolenic acid	7.715	1.421	42.04	C <sub>22:1</sub>	Erucic acid	2.652	1.825					
38.09	C <sub>20:0</sub>	Arachidic acid	0.417	0.050										
41.76	C <sub>22:0</sub>	Behenic acid	0.721	0.730										

N. D. = Not detected

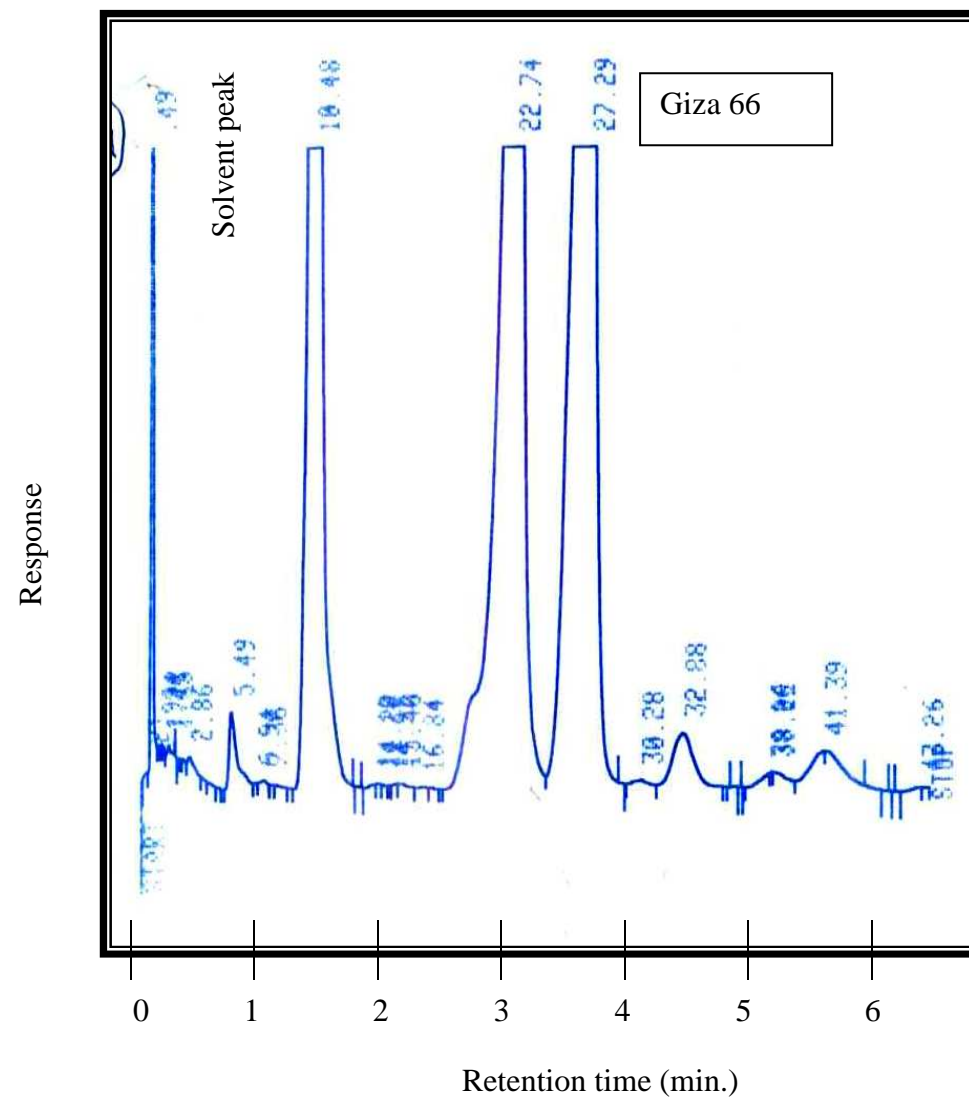
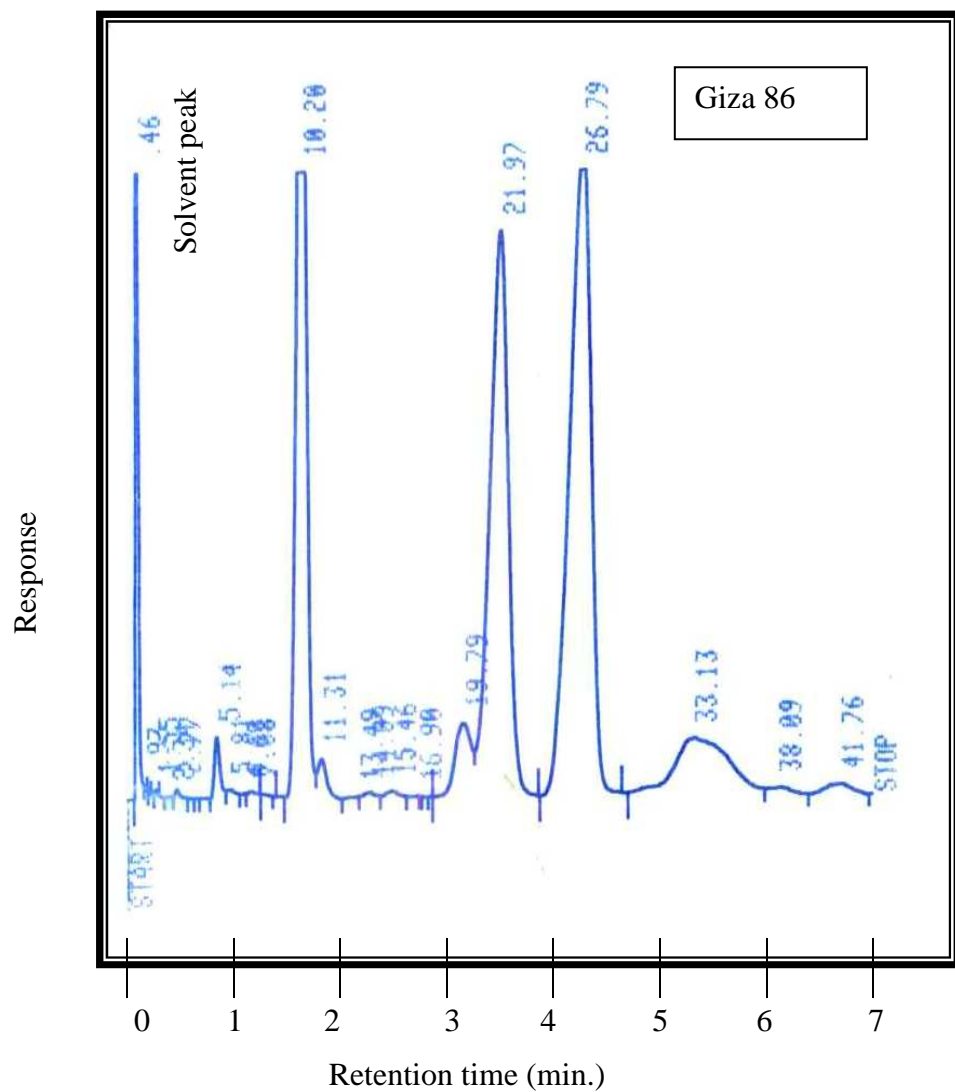


Fig. (1): GLC chromatograms of fatty acids composition of cotton seed oils (cvs. Giza 86 and Giza 66).



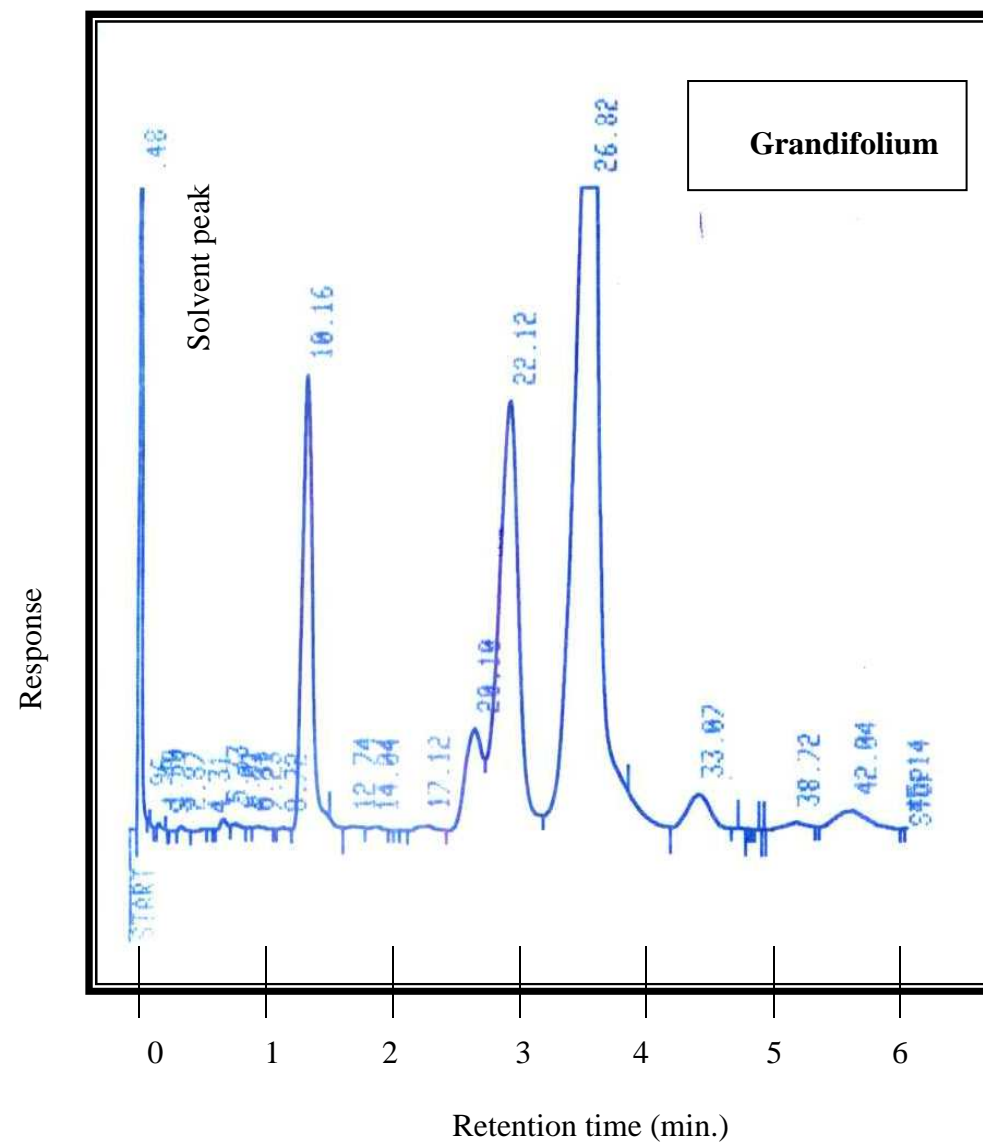
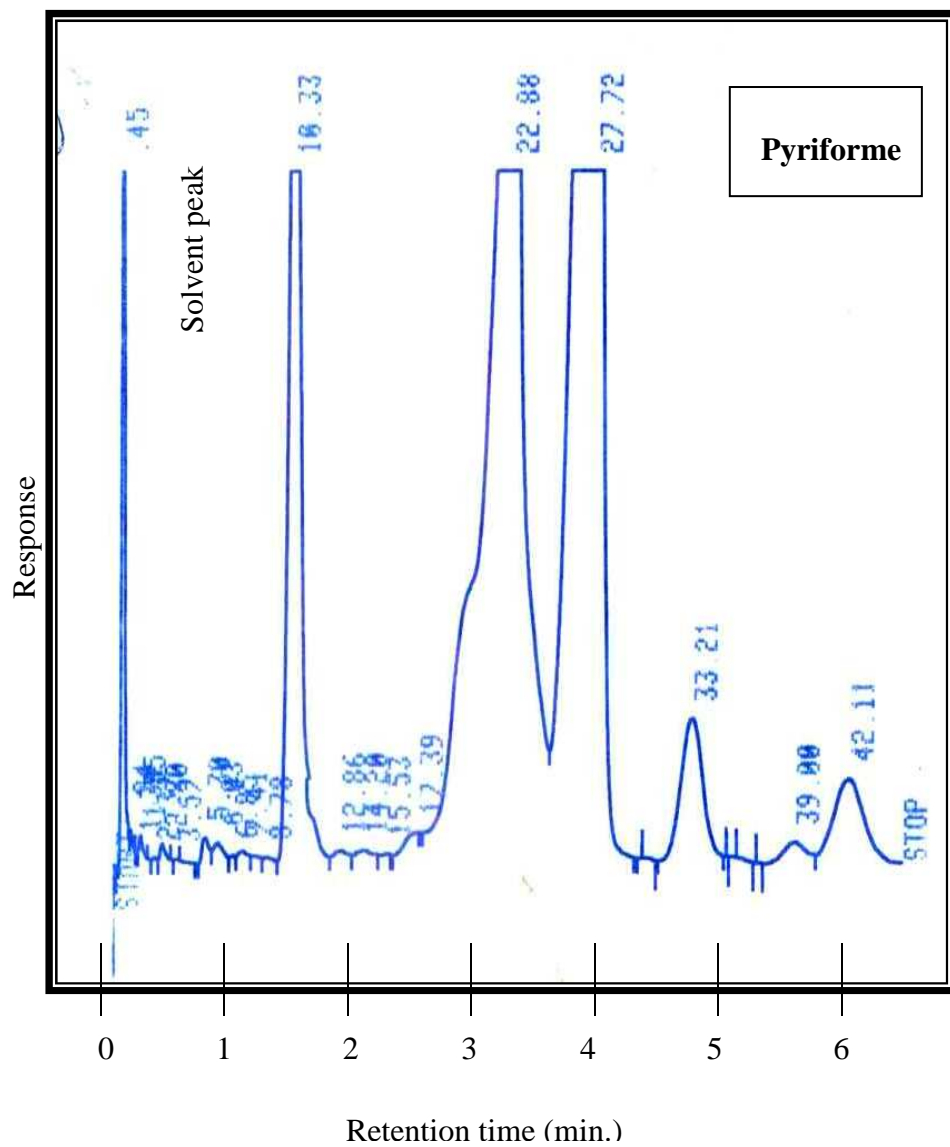


Fig. (2): GLC chromatograms of fatty acids composition of tomato seed oils (*Pyriforme* and *gradnifolium* varieties).

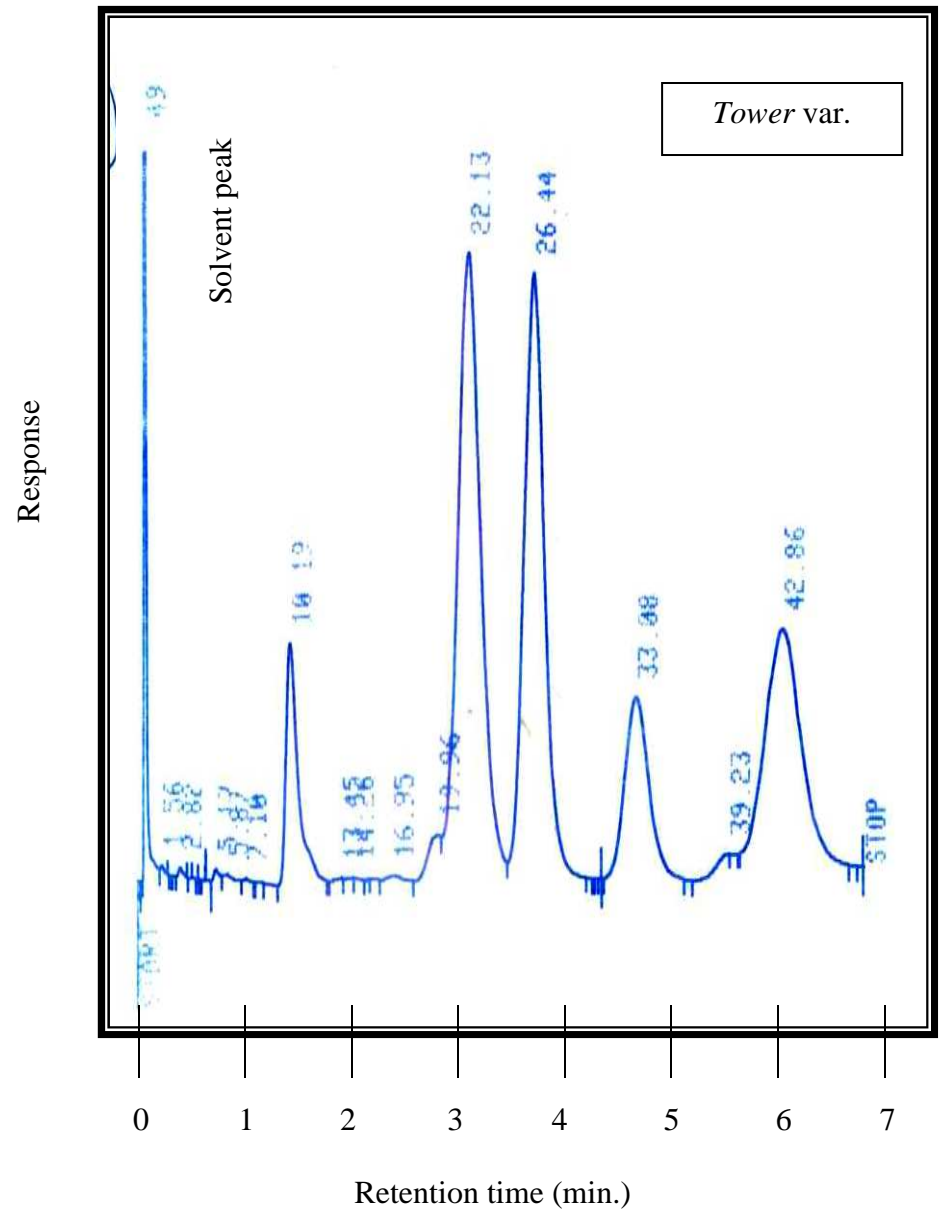
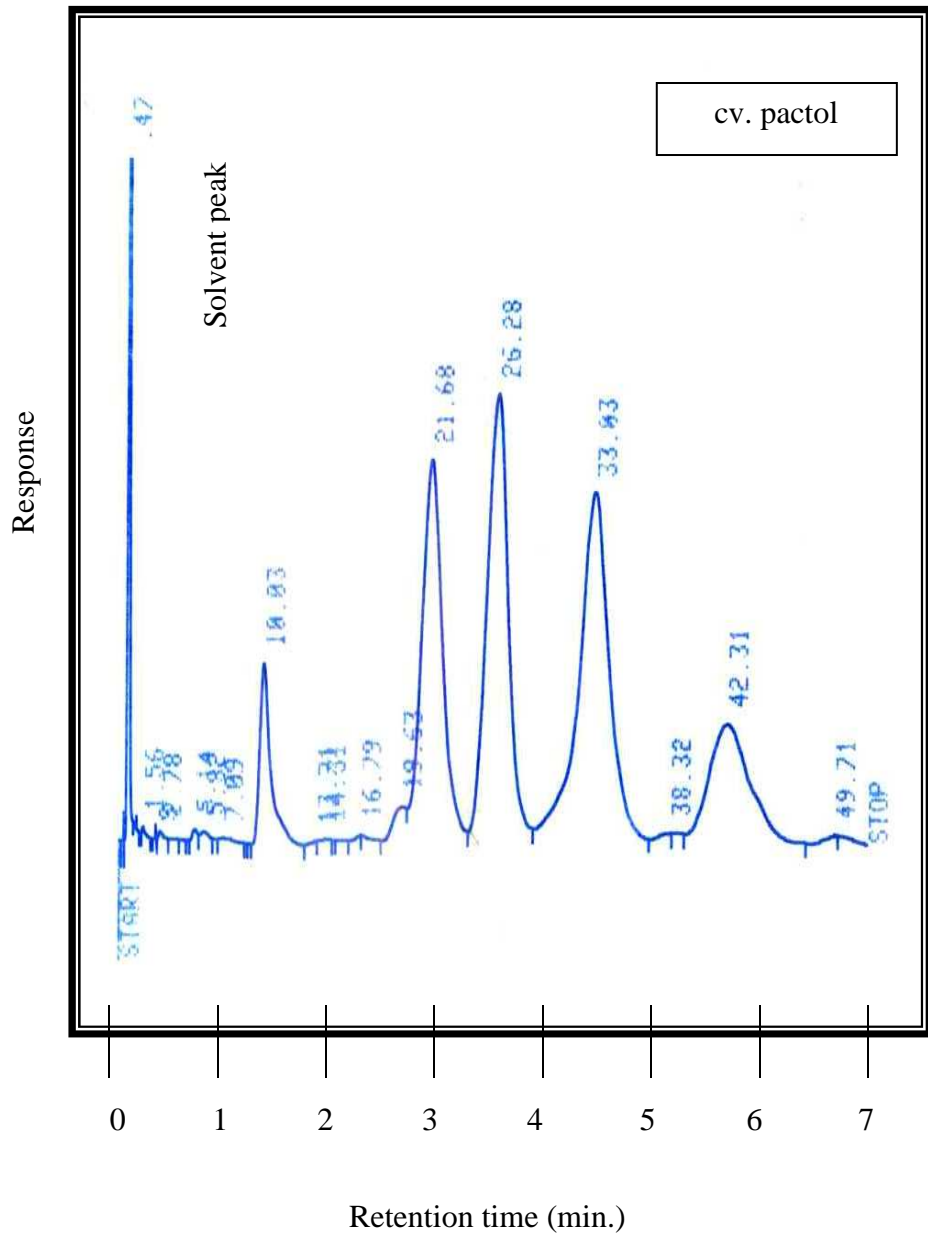


Fig. (3): GLC chromatograms of fatty acids composition of rapeseed oils (cv.Pactol and Tower var.).

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### الملخص العربي

البصمة التشريحية والمكونات الحيوية كوسائل تقسيمية في بعض بذور ذات الفلقتين

#### ١ – المكونات الكيماوية للبذور

على حسن شاهين\* و احمد لطفى ونس\* وفاتن حسن إسماعيل\* و عبدالمجيد على عبدالمجيد\*\* و محمد محمد  
عبدالعال\*

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\*\*معهد بحوث البساتين- وزارة الزراعة

يهدف هذا البحث إلى إجراء دراسة المكونات الكيماوية لبذور ثلاثة أنواع نباتية ، تشمل من كل نوع  
صنفين ، تمثل هذه الأنواع ثلاثة أجناس وثلاثة عائلات هى كالتالى:

من العائلة الخبازية القطن صنف جيزة ٨٦ وصنف جيزة ٦٦

ومن العائلة الباذنجانية الطماطم صنف Pyriforme وصنف grandifolium ومن العائلة الصايبية الشلجم  
صنف Pactor وصنف Tower

وقد تم الحصول على بذور النباتات السابقة الذكر من بنك البذور بقسم بحوث الفلورا وتصنيف النباتات  
(CAIM). معهد بحوث البساتين – مركز البحوث الزراعية.

فى هذا الصدد يهدف هذا البحث إلى إلقاء الضوء على المكونات الكيماوية فى عمليات التمييز  
والتعريف للوحدات التصنيفية تحت الدراسة. كما تؤكد على تسهيل أهمية استعمال المكونات الكيماوية كمعايير  
ودلائل فى الدراسات التصنيفية.

وقد تم تقدير المكونات الكيماوية لبذور الأصناف المدروسة وذلك بتقدير نسبة الزيت – نسبة البروتين  
– نسبة الكربوهيدرات – المحتوى من العناصر – الأحماض الأمينية والأحماض الدهنية لتسهيل الفصل بين  
الوحدات المدروسة. كما تؤكد على أهميتها كمعايير فى المعاملات التصنيفية.

ولقد تبين أن المكونات الكيماوية المختلفة ونسبها تعتبر صفات تشخيصية رائدة حيث تجعل التفريق بين  
الأصناف المختلفة المدروسة أسهل وأكثر فاعلية.