RESULTS AND DISCUSSION

IV. RESULTS AND DISCUSSION

The present study was designed to find out definite-distinguished characters of wheat varieties under tests. This is in order to furnish such needed information to the breeder and the field inspector. The breeders require these data in the evaluation course of their program. In addition, it serves as a true witness in the course of breeder's right implementation. Field inspectors should have recognizable characters of the specific variety under inspection so that such standard of purity might be worked out properly. This could be carried out directly in the field or by taking sample for laboratory analyses. Certain morphological characters and biochemical aspects were therefore needed to be studied to furnish necessary data in this respect.

1. Morphological characteristics:

1.1. Data in Table (2) indicated that the cleoptile anthocyanin coloration of all wheat varieties was absent.

1.2. Regarding the plant growth habit, wheat varieties were intermediate except Sakha 61, Sakha 69, Beni swafe 1, Beni swafe 3 and Sohag 2 varieties which were semi erect.

1.3. Concerning anthocyanin coloration of auricles, Sakha 69 had strong anthocyanin coloration which can be used as a unique character for this variety in this stage while. Sakha 61 and Giza 170 it was weak, and was absent in the other varieties.

1.4. The frequency of plants with recurved flag leaves of Sakha 8, Gemmiza 9, Beni swafe3 and Sohag 2 were low while for the other varieties were medium.

1.5. Results in Table (2) indicated that Sids 7 and Sohag 2 varieties were early in time of (first spekelet visible on 50% of ears) ear emergence while Gemmiza 9 was late which can be used as a unique character for these varieties in this stage. Other varieties were medium. Similar results were obtained by **Hussein *et al.* 1981.**

1.6. For the glaucosity of sheath flag leaf of wheat varieties, three categories could be detected. The first category included Sakha 61, Sakha 69 and Sids 7 with strong glaucosity of sheath flag leaf. The second category included Sakha 8, Giza 170, Beni swafe 1, Beni swafe 3, Sohag 2 and Sohag 3 which were medium glaucosity of sheath flag leaf. The third class included Gemmiza 9 variety in which glaucosity of sheath flag leaf is weak which can used as a unique character for this variety in this stage. These results confirmed those obtained by **Hussein *et al.* 1981.**

1.7. Concerning ear glaucosity, wheat varieties could be classified into three classes. The first class included Sakha 8, Gemmiza 9, Beni swafe 1 and Sohag 3 of weak ear glaucosity. The second category included Sakha 61, Sakha 69, Giza 170 and Beni swafe 3 varieties of medium ear glaucosity. The third category included Sids 7 and Sohag 2 where their ear glaucosity had strong.

1.8. Regarding culm glaucousity of neck, wheat varieties could be classified into three categories. Strong culm glaucosity is in Sids 7 and Sohag 2. The second category included Sakha 61, Sakha 69, Giza 170 Beni swafe 1, Beni swafe 3 and Sohag 3 where their culm glaucosity was medium. Whereas, Sakha 8 and

Gemmiza 9 varieties had weak culm glaucosity as a third category.

1.9. Plant height (Table 2), of Sakha 61 variety were short which can used as a unique character for this variety in this stage, while Sakha 8, Sakha 69, Giza 170, Sids 7, Gemmiza 9, Beni swafe 1, Beni swafe 3, Sohag 2 were medium and Sohag 3 was the tallest which can used as a unique character for this variety in this stage. Similar results were obtained by **Kandil (1985), Gaber (1988)** and **Hussein (1995).**

1.10. Regarding straw pith in cross section, Sakha 61, Sakha 69, Giza 170, Beni swafe 1 and Beni swafe 3 had strow pith thin varieties while Sids 7, Gemmiza 9, Sohag 2 and Sohag 3 had medium and Sakha 8 had the thickest which can used as a unique character for this variety in this stage.

1.11. In respect of ear shape, Sakha 8 and Sakha 61 varieties had of parallel shape, whereas all the other varieties had tapering ear shape.

1.12. As for ear density, Sakha 8, Sakha 61, Sakha 69 and Sids 7 had medium ear density, while Giza 170, Gemmiza 9, Beni swafe 1, Beni swafe 3, Sohag 2 and Sohag 3 were of dence behavior.

1.13. Ear length, of Beni swafe 1, Sohag 2 and Sohag 3 varieties was short ear length, whereas Sakha 8, Sakha 61, Sakha 69, Giza 170 and Beni swafe 3 were medium length but Sids 7 and Gemmiza 9 had the longest ear length.

1.14. Data in Table (2) indicated that all of the varieties had awns type.

1.15. Awns at tip of ear were noticed in Sakha 8, Giza 170 and Sids 7varieties, they had medium awns. But, other varieties had long awns.

1.16. Concerning ear color, only Sakha 8 wheat variety had colored ear which can used as a unique character for this variety in this stage, whereas all the other studied varieties had white ear color.

1.17. In respect to hairness of convex surface, Sakha8, Sakha 69, Sids 7 and Gemmiza 9 had medium hairness while Sakha 61, Giza 170, Beni swafe 1, Beni swafe 3, Sohag 2 and Sohag 3 had weak hairness.

1.18. Regarding shoulder of lower glumes, variety Sakha 8 had broad width shoulder which can be used as a unique character for this variety in this stage, while Sids 7, Gemmiza 9, Beni swafe 1 Beni swafe 3, Sohag 3 had medium shoulder width and Sakha 61, Sakha 69 and Giza 170 had narrow glumes.

1.19. In view of shoulder shape, varieties Sakha 61, Sakha 69 and Beni swafe 3 had sloping shoulder, while Sids 7, Beni swafe 1 and Sohag 3 had slightly sloping shoulder; Sakha 8 and Sohag 2 had straight shoulder; Giza 170 had elevated shoulder which can used as a unique character for this variety in this stage, but Gemmiza 9 had strong shoulder elevated with 2nd point in its shape habit which can be used as a unique character for this variety in this stage.

1.20. Concerning beak length of lower glume the varieties Giza 170 and Gemmiza 9 had short beak while the other varieties had medium beak length.

Table (2): Morphological Characteristics of the studied Wheat varieties during 2001 / 2002 and 2002/2003 growing season

Characteristics	Stage	Degree	Sa. 8	Sa. 61	Sa. 69	G. 170	Si. 7	Gem .9	Bs. 1	Bs. 3	So. 2	So. 3
1. Coleoptile: anthocyanin coloration	09-11 VS	Absent or very weak (1) Weak (3) Medium (5) Strong (7) Very strong (9)	1	1	1	1	1	1	1	1	1	1
2. Plant: growth habit	25-29 VG	Erect (1) Semi-erect (3) Intermediate (5) Semi-prostrate (7) Prostrate (9)	5	3	3	5	5	5	3	3	3	5
3. Flag leaf: anthocyanin coloration of auricles	49-51 VG	Absent or very weak (1) Weak (3) Medium (5) Strong (7) Very strong (9)	1	3	7	3	1	1	1	1	1	1

Table (2): Cont.

Characteristics	Stage	Degree	Sa. 8	Sa. 61	Sa. 69	G. 170	Si. 7	Gem .9	Bs. 1	Bs. 3	So. 2	So. 3
4. Plant: frequency of plants with recurved flag leaves	47-51 VG	Absent or very low (1) Low (3) Medium (5) High (7) Very high (9)	3	5	5	5	5	3	5	3	3	5
5. Time of ear emergence (first spikelet visible on 50% of ears)	50-52 VG	Very early (1) Early (3) Medium (5) Late (7) Very late(9)	5	5	5	5	3	7	5	5	3	5
6. Flag leaf: glaucosity of sheath	60-65 VG	Absent or very weak (1) Weak (3) Medium (5) Strong (7) Very strong (9)	5	7	7	5	7	3	5	5	5	5

Table (2): Cont.

Characteristics	Stage	Degree	Sa. 8	Sa. 61	Sa. 69	G. 170	Si. 7	Gem .9	Bs. 1	Bs. 3	So. 2	So. 3
7. Ear: glaucosity	60-69 VG	Absent or very weak (1) Weak (3) Medium (5) Strong (7) Very strong (9)	3	5	5	5	7	3	3	5	7	3
8. Culm: glaucosity of neck	60-69 VG	Absent or very weak (1) Weak (3) Medium (5) Strong (7) Very strong (9)	3	5	5	5	7	3	5	5	7	5
9. Plant: length (stem, ear, awns and scurs)	75-92 M	Very short (1) Short (3) Medium (5) Long (7) Very long (9)	5	3	5	5	5	5	5	5	5	7
10. Straw: pith in cross section (halfway between base of ear and stem node below)	80-92 VS	Thin (3) Medium (5) Thick (7)	7	3	3	3	5	5	3	3	5	5

Table (2): Cont.

Characteristics	Stage	Degree	Sa. 8	Sa. 61	Sa. 69	G. 170	Si. 7	Gem .9	Bs. 1	Bs. 3	So. 2	So. 3
11. Ear: shape in profile	92 VS	Tapering (1) Parallel sided (2) Semi-clavate (3) Clavate (4) Fusiform (5)	2	2	1	1	1	1	1	1	1	1
12. Ear: density	80-92 VS or M	Very lax (1) Lax (3) Medium (5) Dense (7) Very dense (9)	5	5	5	7	5	7	7	7	7	7
13. Ear: length (excluding awns and scurs)	80-92 M	Very short (1) Short (3) Medium (5) Long (7) Very long (9)	5	5	5	5	7	7	3	5	3	3
14. Awns or scurs: presence	80-92 M	Both absent (1) Scurs present (2) Awns present (3)	3	3	3	3	3	3	3	3	3	3

Table (2): Cont.

Characteristics	Stage	Degree	Sa. 8	Sa. 61	Sa. 69	G. 170	Si. 7	Gem .9	Bs. 1	Bs. 3	So. 2	So. 3
15.Awns or scurs at tip of ear: length	80-92 VG	Very short (1) Short (3) Medium (5) Long (7) Very long (9)	5	7	7	5	5	7	7	7	7	7
16. Ear: color	90-92 VG	White (1) Colored (2)	2	1	1	1	1	1	1	1	1	1
17. Apical rachis segment: hairiness of convex surface	80-92 VS	Absent or very weak (1) Weak (3) Medium (5) Strong (7) Very strong (9)	5	3	5	3	5	5	3	3	3	3
18. Lower glume: shoulder width (spikelet in midthird of ear)	80-92 VS	Absent or very narrow (1) Narrow (3) Medium (5) Broad (7) Very broad (9)	7	3	3	3	5	5	5	5	5	5

Table (2): Cont.

Characteristics	Stage	Degree	Sa. 8	Sa. 61	Sa. 69	G. 170	Si. 7	Gem .9	Bs. 1	Bs. 3	So. 2	So. 3
19. Lower glume: shoulder shape (as for 18)	80-92 VS	Sloping (1) Slightly sloping (3) Straight (5) Elevated (7) Strongly elevated with 2nd point present (9)	5	1	1	7	3	9	3	1	5	3
20. Lower glume: beak length (as for 18)	80-92 VS	Very short (1) Short (3) Medium (5) Long (7) Very long (9)	5	5	5	3	5	3	5	5	5	5
21. Lower glume: beak shape (as for 18)	80-92 VS	Straight (1) Slightly curved (3) Moderately curved (5) Strongly curved (7) Geniculate (9)	1	1	1	1	5	1	5	3	3	5
22. Lower glume: extent of internal hairs (as for 18)	80-92 VS	Weak (3) Medium (5) Strong (7)	5	5	5	3	5	3	5	5	5	5

Table (2): Cont.

Characteristics	Stage	Degree	Sa. 8	Sa. 61	Sa. 69	G. 170	Si. 7	Gem .9	Bs. 1	Bs. 3	So. 2	So. 3
23. Lowest lemma: beak shape (as for 18)	80-92 VS	Straight (1) Slightly curved (3) Moderately curved (5) Strongly curved (7) Geniculate (9)	5	5	5	1	5	3	3	5	3	5
24. Grain: color	92 VG	White (1) Red (2)	1	1	1	1	1	1	1	1	1	1
25. Grain: coloration with phenol	92 VS	Non or very light (1) Light (3) Medium (5) Dark (7) Very dark (9)	5	9	9	7	9	9	1	1	1	1
26. Seasonal type	- VG	Winter type (1) Alternative type (2) Spring type (3)	3	3	3	3	3	3	3	3	3	3

Unique character

VG = Vegetative stage

M = Maturity

1.21. The beak shape of lower glume for wheat varieties could be classified into three categories. The first category included varieties Sakha 8, Sakha 61, Sakha 69, Giza 170 and Gemmiza 9 which had straight beak shape. The second category included varieties Beni swafe 3 and Sohag 2 that had slightly curved beak shape. The varieties Sids 7, Benis wafe 1 and Sohag 3 had moderately curved beak shape of lower glume as a third category.

1.22. Concerning extent of internal hairs of lower glume (Table 2), Giza 170 and Gemmiza 9 had weak extent of internal hairs, while other studied varieties had medium extent.

1.23. Regarding beak shape of the lowest lemma, the variety Giza 170 had straight beak shape of the lowest lemma which can used as a unique character for this variety in this stage, while Gemmiza 9, Beni swafe 1 and Sohag 2 had slightly curved one, and Sakha 8, Sakha 61, Sakha 69, Sids 7, Beni swefe 3 and Sohag 3 had moderately curved beak shape of lowest lemma.

1.24. Data in (Table 2) indicated that the wheat varieties were similar in grain color and seasonal type. Therefore, these characters could not be used as a descriptor for wheat varieties under the studied conditions.

1.25. Concerning grain coloration with phenol, Beni swefe 1, Beni swefe 3, Sohag 2 and Sohag 3 were stained with very light red coloration, while grains of Sakha 8 stained with medium coloration which can used as a unique character for this variety in this stage, but grains of Giza 170 stained with dark red color which can used as a unique character for this variety in this stage and grains of Sakha 61, Sakha 69, Sids 7 and Gemiza 9

were stained with very dark color. Similar results were obtained by **Gandy (1996).**

2. Seed quality:

2.1. Physiological characteristics:

2.1.1. The 1000-grain weight:

Significant differences among the studied wheat varieties were obtained in 1000- grain weight (Table 3). Variety Sids 7 had the heaviest weight with an average of 52.17g. While variety Giza 170 had the lightest weight of (34.35g). The significant difference in grain weight among the studied wheat varieties revealed that this character is a good descriptor for identifying wheat varieties. These results are generally in agreement with those of **Pommer and Oppitz (1986), Gaber (1978)** and **El-kAlla *et al.* (1992).**

2.1.2. Standard germination test:

The standard germination test does not consistently predicts the field performance of a seed lot. As a result, seed scientists have emphasized the development of another seed quality parameter as seed vigour. This is defined as seed properties, which determine the potential for rapid uniform emergence and development of normal seedling under a wide range of field conditions **(ISTA, 1992).**

The maximum potential for seed vigour expression in most crops is achieved when the seed is at its maximum dry weight, a stage known as physiological maturity. This requirement places stringent burdens on the production and marketing for only the

highest quality seed. High value seed are increasingly when exposed to varying pretreatments to improve their performance.

Data in Table (3) showed significant differences among varieties of high germination percentage (Sakha 61, Sakha 69, Giza 170, Sids 7, Beni swafe 1 and Beni swafe 3),whereas, Gemmiza 9 recorded the lowest germination percentage.

2.1.3. Electrical conductivity test (EC):

Concerning the electric conductivity, Gemmiza 9 recorded the highest value, whereas Sohag 2 was of the lowest value. Moreover, data revealed significant differences between the studied varieties as it is clear from the data presented in Table (3). The results revealed that there were insignificant negative relationship between the germination percentage and electric conductivity. The coefficient for relationship between the value of germination test and electric conductivity was (R= -0.3684).

2.4. Accelerated ageing test (AA):

The accelerated ageing test is one of the most popular seed vigour tests due to its simplicity and ease of implementation and standardization.

According to the results presented in Table (3), the studied varieties showed significant differences in response to their accelerated ageing test. The lowest response to accelerated ageing was obtained for Sakha 61, Sakha 69, Sids 7, Beni swafe 1 and Sohag 3. Whereas, Sohag 2 showed the highest response to accelerated ageing. There was a significant positive relationship between germination percentage and the germination after accelerated ageing test The coefficient for relationship between

the value of germination test and accelerated ageing test was (R= 0.8411).

Table (3): Means of 1000-grain weight (g), germination (%), accelerated ageing (%) and electric conductivity (µmohs/ cm^3) for the studied wheat varieties (data for combined over the two growing seasons 2001/2002 and 2002/2003).

Variety	1000-grain weight (g)	Germination (%)	Accelerated ageing (%)	Electric conductivity (µmohs/ cm^3)
Sakha 8	42.76 ^{D}	93.00 ^{B}	83.50 ^{C}	27.80 ^{BC}
Sakha 61	40.46 ^{E}	97.00 ^{A}	91.50 ^{AB}	28.90 ^{BC}
Sakha 69	43.38 ^{D}	98.50 ^{A}	94.00 ^{A}	28.95 ^{BC}
Gemmiza 9	37.38 ^{F}	89.00 ^{C}	80.50 ^{D}	33.00 ^{A}
Giza 170	34.35 ^{G}	97.00 ^{A}	90.50 ^{B}	29.25 ^{B}
Sids 7	52.17 ^{A}	98.50 ^{A}	93.00 ^{AB}	29.05 ^{B}
Beni swafe 1	50.79 ^{B}	98.50 ^{A}	93.50 ^{A}	27.90 ^{BC}
Beni swafe 3	43.69 ^{D}	97.00 ^{A}	85.50 ^{C}	28.05 ^{BC}
Sohag 2	51.06 ^{AB}	93.50 ^{B}	77.50 ^{E}	25.25 ^{D}
Sohag 3	48.24 ^{C}	96.50 ^{A}	92.00 ^{AB}	27.05 ^{C}

3. Chemical composition:

3.1. Crude protein content

Results in Table (4) showed the total crude protein percentage in wheat varieties under study. The present data indicated that the highest protein percentage was recorded for Beni swafe 3 (12.95%). On the other side, the lowest one was found in Giza 170 variety (9.87%). Whereas, the other varieties were found to have protein percentage ranged from 12.95% to 9.87%. These results are in general agreement with those obtained by **Ghanem *et al* (1987).**

3.2. Total carbohydrate

The averages of seed's total carbohydrate content of the studied wheat varieties are shown in Table (4). The results revealed such varieties could be classified into three categories depending upon their carbohydrate content as follows:

Category 1: contained total carbohydrate in the range of 79.88% to 77.58% which included Giza 170, Sakha 8, Sids 7, Sakha 69 and Sakha 61 varieties.

Category 2: was noticed for Beni swafe 1 and Gemmiza 9 with an average carbohydrate percentage from 76.41% to 77.16%.

Category 3: included varieties which have total carbohydrate in the range of 73.18 % to 74.48 % as for Sohag2, Sohag 3and Beni swafe 3.

Table (4): Crude protein and carbohydrate contents for seeds of the studied wheat varieties combined over the two growing seasons (2001/2002 and 2002/2003).

Variety	Protein %	Carbohydrate %
Sakha 8	10.23 ^{C}	78.81 ^{AB}
Sakha 61	11.55 ^{B}	77.79 ^{AB}
Sakha 69	10.82 ^{D}	78.79 ^{AB}
Gemmiza 9	12.05 ^{BC}	77.16 ^{B}
Giza 170	9.87 ^{E}	79.88 ^{A}
Sids 7	11.85 ^{BC}	77.58 ^{AB}
Beni swafe 1	12.14 ^{B}	76.41 ^{BC}
Beni swafe 3	12.95 ^{A}	73.18 ^{D}
Sohag 2	12.33 ^{B}	73.25 ^{D}
Sohag 3	12.23 ^{B}	74.48 ^{CD}

3.3. Protein fractionation:-

Total seed protein contents of each of ten wheat varieties were analyzed for their electrophoretic banding patterns using SDS-PAGE. Molecular weights and percentage (% total proteins) of these protein bands are given in Table (5) and Fig (1). It is clear that the banding pattern were 15,12,15,11,15,17,15,14,15 and 15 bands for major proteins of Sakha 8, Sakha 61, Sakha 69, Giza 170, Sids 7, Gemmiza 9. Beni swafe 1, Beni swafe 3, Sohag 2 and Sohag 3 wheat varieties, respectively .

The results indicated distinct differences in seed protein banding patterns between the various studied varieties, the variety Sakha 8 was characterized by proteins of molecular weights of 113.107, 81.529, 70.202, 45.778 and 19.885 KD .The concentration in seed proteins were 4.941, 3.864, 5.304, 3.712 and 11.339% respectively. Seeds of Sakha 61 contained proteins with molecular weight of 41.032 KD with concentration of 4.154% of total proteins. Sakha 69 seeds had proteins of molecular weights of 93.518, 88.117, 64.929 and 52.250 KD.

Their respective concentrations were 1.325, 3.031, 5.158 and 3.034% of total proteins. Giza170 seeds had proteins of molecular weights of 83.833 and 49.613. The percentage of total proteins reached 5.405 and 6.030% of total proteins. Sids 7 characterized by proteins of molecular weights of 76.718 and 50.519 KD.

There concentrations in seeds proteins were 4.700 and 3.404% respectively. Seeds of Gemmiza 9 contained proteins of molecular weight of 90.066 KD. The percentage of total proteins reached 9.749% of total proteins. Beni swafe 1 seeds had proteins of molecular weight of 89.577, 48.996 and 42.062 KD. The respective concentrations are 3.755, 6.350 and 2.471% of total proteins. Seeds of Beni swafe 3 contained proteins of molecular weights of 111.371kD. With respective concentration of 19.210%.Sohag 2 seeds had proteins of molecular weights of 109.635, 97.868 and 84.771kD. Their percentage of total proteins reached 15.426, 3.036 and 5.480% of total protein, respectively. Sohag 3 characterized by protein of molecular weights of 102.015, 86.194 and 44.442 KD. Their respective concentrations in seed protein were 6.739, 3.497 and 5.323%,

respectively. These findings are in accordance with those obtained by **Ebrahim, Eman (1999)** and **Selim, Amal (2000).**

It could be concluded that, the number of protein bands and the presence and absence of certain protein bands as well as the relative concentrations of protein bands can be used to characterize the various wheat varieties under study. Also, the unique protein profile for each of the 10 wheat varieties under study showed a similarity in same bands. Similarities were considered when more than 5 varieties were showed in similar bands with different magnitudes. So, in the bands of M.W. 105.102, 98.929, 61.390, 60.651and 59.023 could be detected in most varieties. Also, there were slight differences in some bands which could be identified in some varieties and could not identify on the others. Similar results were obtained by **Fiueroa and Khan (1993)** mentioned that the major protein bands fractionated by SDS-PAGE electrphoresis from different wheat protein had approximately 7.42 to 253 KD. From the above mentioned data, it can be found that certain protein of different set in 5, 1, 4, 2, 2, 1, 4, 1, 3 and 3 protein banding patterns for the varieties Sakha 8, Sakha61, Sakha69, Giza 170, Sids 7, Gemmiza 9, Beni swafe 1, Beni swafe 3, Sohag 2 and Sohag 3, respectively.

Therefore, the electrophortic differences observed in this study should provide a comprehensive supplemental means for cultivar identification. These findings indicated clearly that electrophortic analysis is an important tool for the identification of wheat cultivars, especially those with no or similar morphological differences. These observations are compatible with those obtained by **Das *et al.* (1992).** From the previous

results, it is clear that some morphological and chemical characters could be used for describing some wheat varieties.

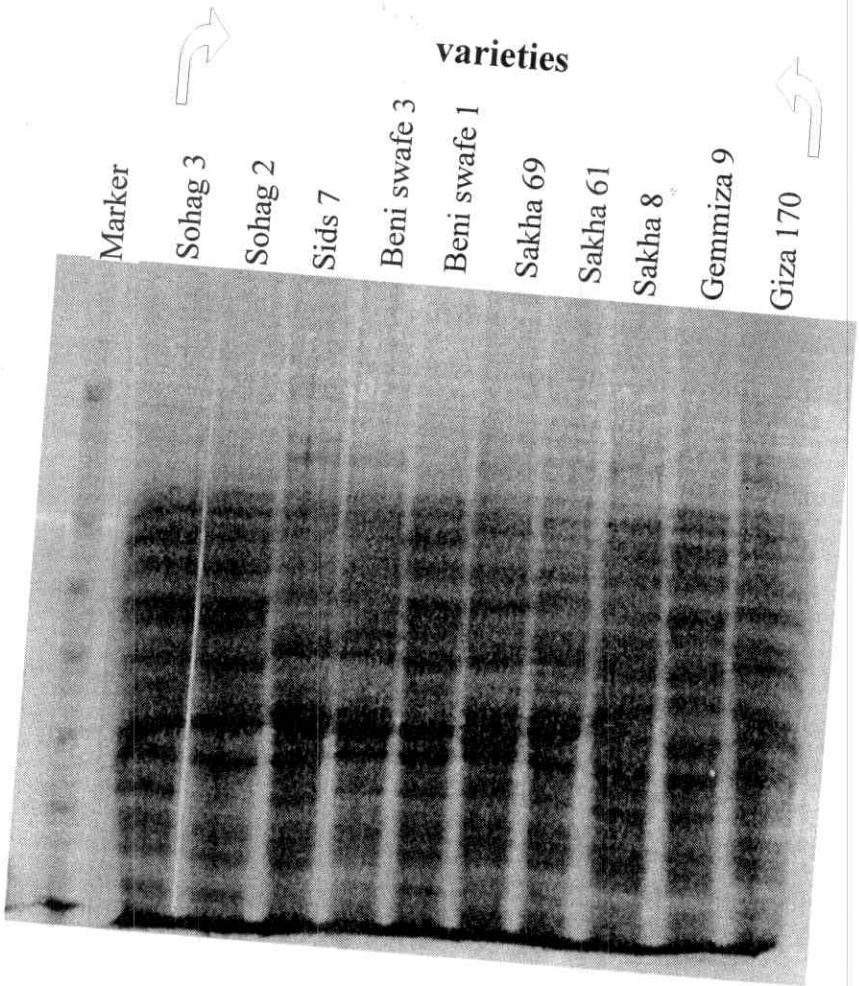


Figure (1): SDS-PAGE electrophoresis of seed protein fraction

Table (5): Results of SDS-PAGE electrophoresis of seed protein fraction (% total protein) of the studied wheat varieties.

Protein (M.W) K.D.	Sak. 8	Sak. 61	Sak. 69	G. 170	Si. 7	Gem. 9	B.s 1	B. s3	So. 2	So. 3
113.107	4.941	-	-	-	-	-	-	-	-	-
112.721	-	-	18.393	26.1149	1.844	20.218	16.182	82.7519	-	-
111.371	-	-	-	-	-	-	-	19.210	-	-
110.020	21.938	-	-	-	22.038	-	-	-	-	-
109.635	-	-	-	-	-	-	-	-	15.426	-
108.670	-	-	12.204	-	-	8.847	15.429	-	-	6.082
107.030	-	10.005	-	-	7.089	-	-	-	14.575	11.175
106.741	5.891	-	-	-	-	4.834	-	2.515	-	-
105.102	11.470	15.323	-	11.791	12.639	5.554	-	-	-	13.184
104.812	-	-	17.588	-	-	-	11.455	-	-	-
103.462	-	-	-	-	-	9.216	-	-	10.005	-
102.015	-	-	-	-	-	-	-	-	-	6.739
101.244	3.797	3.530	-	4.919	6.507	-	-	-	2.937	-
100.665	-	-	-	-	-	2.717	3.475	-	3.739	4.027
99.218	3.361	6.209	-	10.118	-	-	-	-	-	-
98.929	-	-	4.403	-	8.082	3.728	3.974	-	-	3.281

Table (5): Cont.

Protein (M.W) K.D.	Sak. 8	Sak. 61	Sak. 69	G. 170	Si. 7	Gem. 9	B.s 1	B. s3	So. 2	So. 3
97.868	-	-	-	-	-	-	-	-	3.036	-
96.502	5.289	12.005	-	-	-	-	-	-	-	-
93.518	-	-	1.325	-	-	-	-	-	-	-
90.066	-	-	-	-	-	9.749	-	-	-	-
89.577	-	-	-	-	-	-	3.755	-	-	-
88.117	-	-	3.031	-	-	-	-	-	-	-
86.194	-	-	-	-	-	-	-	-	-	3.497
84.771	-	-	-	-	-	-	-	-	5.480	-
83.833	-	-	-	5.405	-	-	-	-	-	-
81.529	3.864	-	-	-	-	-	-	-	-	-
76.718	-	-	-	-	4.700	-	-	-	-	-
74.877	-	-	6.288	-	-	-	2.580	-	-	-
71.258	-	-	-	8.091	-	-	-	-	5.224	6.487
70.202	5.304	-	-	-	-	-	-	-	-	-
66.8935	-	2.7375	-	-	5.248	1.934	-	-	-	-
64.929	-	-	5.158	-	-	-	-	-	-	-
62.302	-	5.946	-	-	-	3.980	5.665	-	-	7.227
61.390	7.715	0.420	1.646	0.884	1.173	3.257	-	9.529	4.179	9.464

Table (5):Cont.

Protein (M.W) K.D.	Sak. 8	Sak. 61	Sak. 69	G. 170	Si. 7	Gem. 9	B.s 1	B. s3	So. 2	So. 3
60.651	4.979	-	4.216	8.978	5.995	4.253	10.562	6.702	7.173	-
59.023	3.243	20.152	7.030	6.100	7.506	5.218	2.607	2.959	8.106	1.587
58.937	-	-	3.050	-	-	-	3.463	-	-	-
55.990	-	-	-	-	-	-	0.469	-	-	-
54.111	-	-	-	-	2.661	-	-	-	-	4.685
53.070	-	-	-	-	-	3.734	-	3.548	-	-
52.250	-	-	3.034	-	-	-	-	-	-	-
50.519	-	-	-	-	3.404	-	-	-	-	-
49.613	-	-	-	6.030	-	-	-	-	-	-
48.996	-	-	-	-	-	-	6.350	-	-	-
46.764	-	5.698	-	-	-	3.863	-	5.938	6.617	-
45.778	3.712	-	-	-	-	-	-	-	-	-
44.442	-	-	-	-	-	-	-	-	-	5.323
42.062	-	-	-	-	-	-	2.471	-	-	-
41.032	-	4.154	-	-	-	-	-	-	-	-
40.000	-	-	-	11.570	6.745	-	-	-	-	-
39.125	-	-	2.802	-	-	-	-	-	3.102	-
35.773	2.932	-	-	-	-	-	11.511	-	-	13.043

Table (5): Cont.

Protein (M.W) K.D.	Sak. 8	Sak. 61	Sak. 69	G. 170	Si. 7	Gem. 9	B.s 1	B. s3	So. 2	So. 3
34.024	-	-	9.832	-	-	4.411	-	-	-	-
32.712	-	13.823	-	-	-	-	-	-	6.887	-
24.549	-	-	-	-	4.370	4.489	-	11.391	-	-
21.925	-	-	-	-	-	-	-	-	3.516	4.201
19.885	11.339	-	-	-	-	-	-	-	-	-
No. of distinguish bands	5	1	4	2	2	1	4	1	3	3
No. of total bands	15	12	15	11	15	17	15	14	15	15

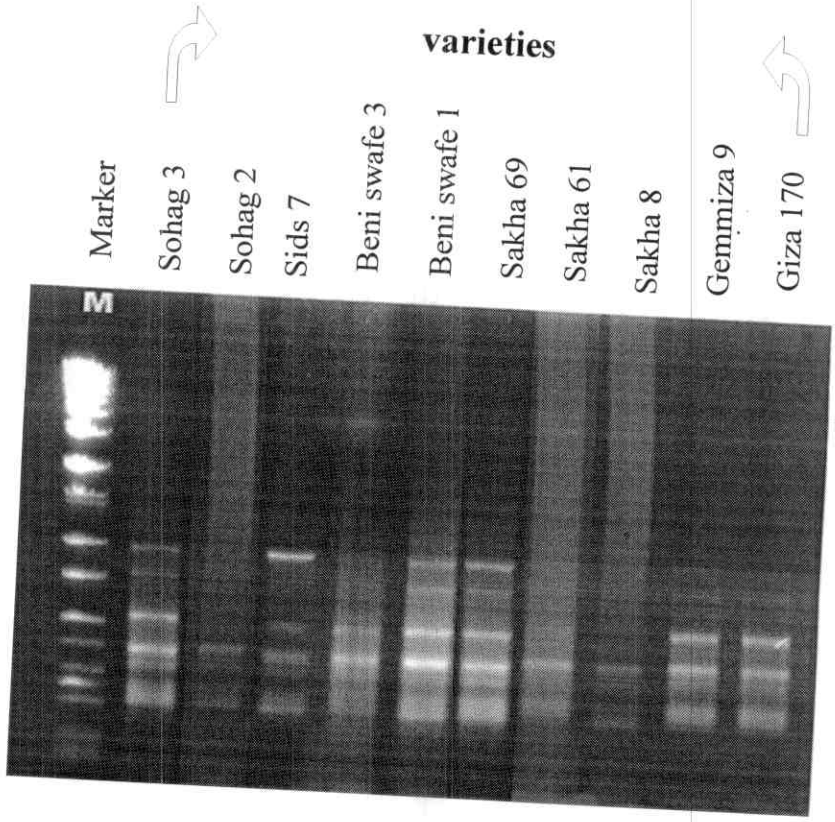
3.4. Molecular analysis:

3.4.1. Randomly amplified polymorphic DNA (R A P D) fingerprint

The randomly amplified polymorphic DNA (RAPD) technique has been used in many different applications involving the variety identification in the present study. Five 10_mer random primers were used to differentiate between the ten wheat cultivars as fallows:

1-The primer OP- A 09

The results of primer OP- A 09 are shown in Figure (2) and Table (6). It exhibited a maximum of six bands which ranged from 3700bp to 875 bp. There were two observed common bands in all of the studied wheat cultivars which were at 1390bp and 875 bp.



Figure(2): DNA polymorphism of the ten wheat cultivars using randomly amplified polymorphic DNA with the primer OP- A09

Table (6): DNA polymorphism using randomly amplified polymorphic DNA with the primer OP-A 09 .

Band no.	MW	Cultivar								
		So. 3	So. 2	Si. 7	B.s 1	B.s 2	Sa. 69	Sa. 61	Sa. 8	Gem .9	G. 170
1	3700	1	0	1	1	1	1	0	0	1	1
2	2910	1	0	1	1	1	1	0	0	1	1
3	1960	1	0	1	1	1	1	1	0	1	1
4	1390	1	1	1	1	1	1	1	1	1	1
5	1235	1	0	1	0	0	1	0	0	1	1
6	875	1	1	1	1	1	1	1	1	1	1

0 = absent band 1= present band

2-The primer OP-A 10

The results of primer OP -A 10 in DNA polymorphism of the studied wheat varieties are shown in Figure (3) and Table (7). It gave a maximum of ten amplified products at the molecular sizes that ranged between 6245bp to 1075bp. One common band was observed in all cultivars which was 2570bp. Some unique bands distinguished two cultivars, one for cultivar Sohag 3 at 3630bp and the other for Gemmiza 9 at 1075bp.

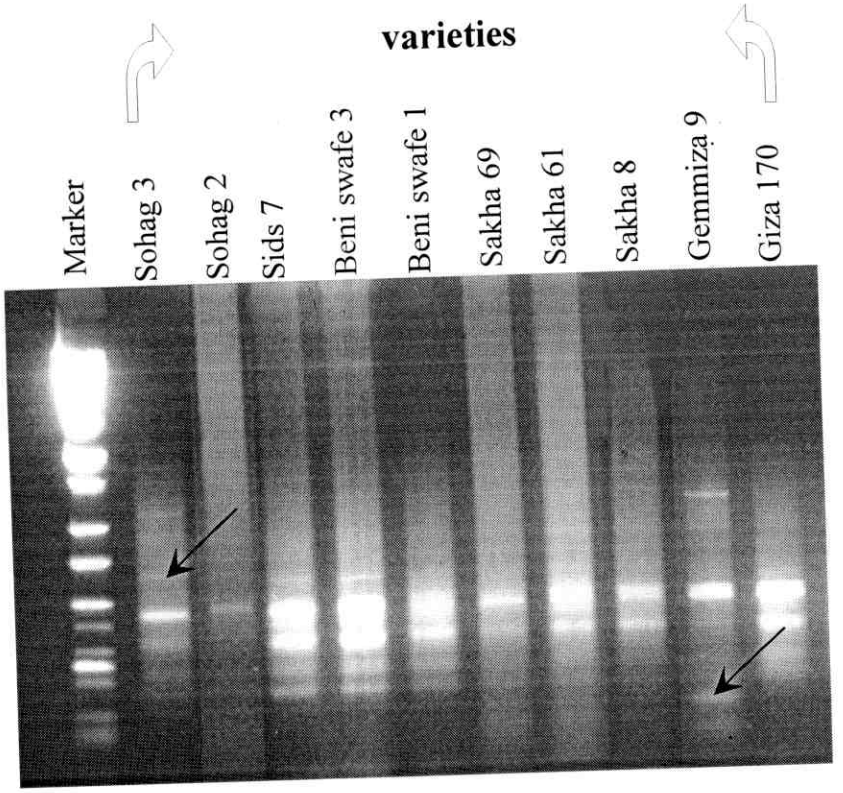


Figure (3): DNA polymorphism of the ten wheat cultivars using randomly amplified polymorphic DNA with the primer OP- A10

Table (7): DNA polymorphism using randomly amplified polymorphic DNA with the primer OP-A 10

Band no.	MW	Cultivar									
		So. 3	So. 2	Si. 7	B.s 1	B.s 2	Sa. 69	Sa. 61	Sa. 8	Gem.9	G. 170
1	6245	1	0	0	0	0	0	0	0	1	0
2	5040	1	0	0	0	0	0	1	0	1	0
3	3630	1	0	0	0	0	0	0	0	0	0
4	3290	0	0	1	0	0	1	0	0	1	1
5	2570	1	1	1	1	1	1	1	1	1	1
6	2250	0	0	1	0	0	1	0	0	0	1
7	1940	1	0	1	1	1	1	1	1	0	1
8	1540	0	0	1	1	0	1	1	0	0	1
9	1285	0	0	1	1	0	1	0	0	0	1
10	1075	0	0	0	0	0	0	0	0	1	0

0 = absent band 1 = present band ☐ Unique band

3-The primer OP-A13

The results of the DNA polymorphism when using the primer OP-A13 are shown in Figure (4) and Table (8). It exhibited a maximum of five bands which were ranged between 2210 bp to 910bp.

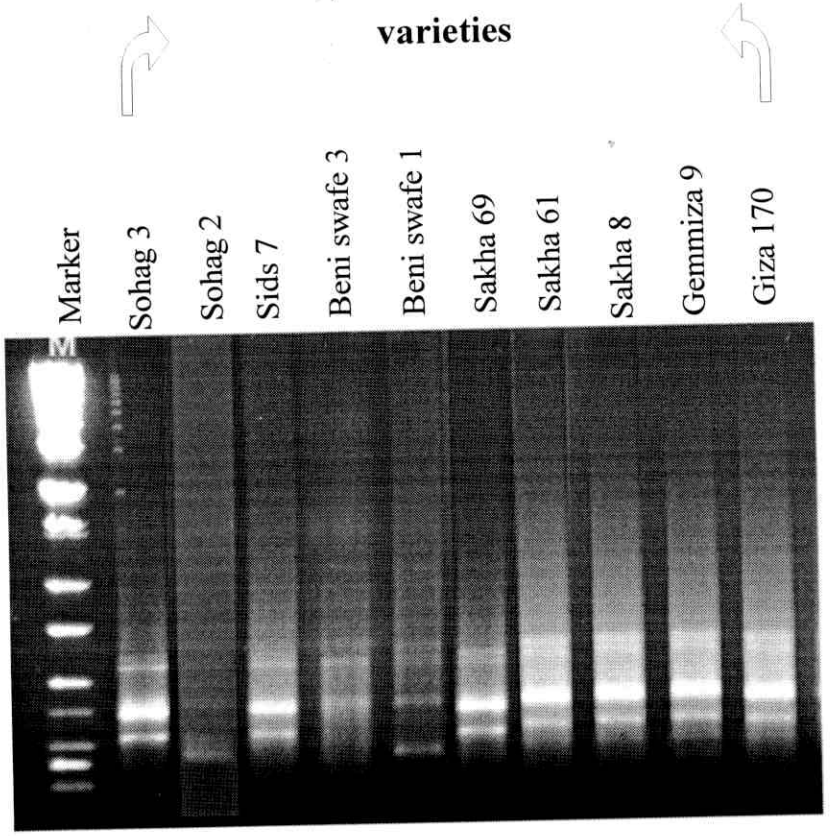


Figure (4): DNA polymorphism of the ten wheat cultivars using randomly amplified polymorphic DNA with the primer OP- A13

Table (8): DNA polymorphism using randomly amplified polymorphic DNA with the primer OP-A 13

Band no.	MW	Cultivar									
		So. 3	So. 2	Si. 7	B.s 1	B.s 2	Sa. 69	Sa. 61	Sa. 8	Gem.9	G. 170
1	2210	1	0	1	0	1	1	1	1	1	1
2	1960	1	0	1	1	0	1	1	1	1	1
3	1290	1	0	1	1	1	1	1	1	1	1
4	1030	1	1	1	1	0	1	1	1	1	1
5	910	0	1	0	0	1	0	1	1	1	1

0 = absent band 1= present band

4-The primer OP-A 20

The results of using the primer OP-A 20 are illustrated in Figure (5) and Table (9). This primer produced a maximum of six amplification products of molecular sizes which ranged from 2720 bp to 1070bp. There were two common bands which were observed in all cultivars at 1595bp and 1070bp. One specific band for cultivar Gemmiza 9 at 2385 bp.

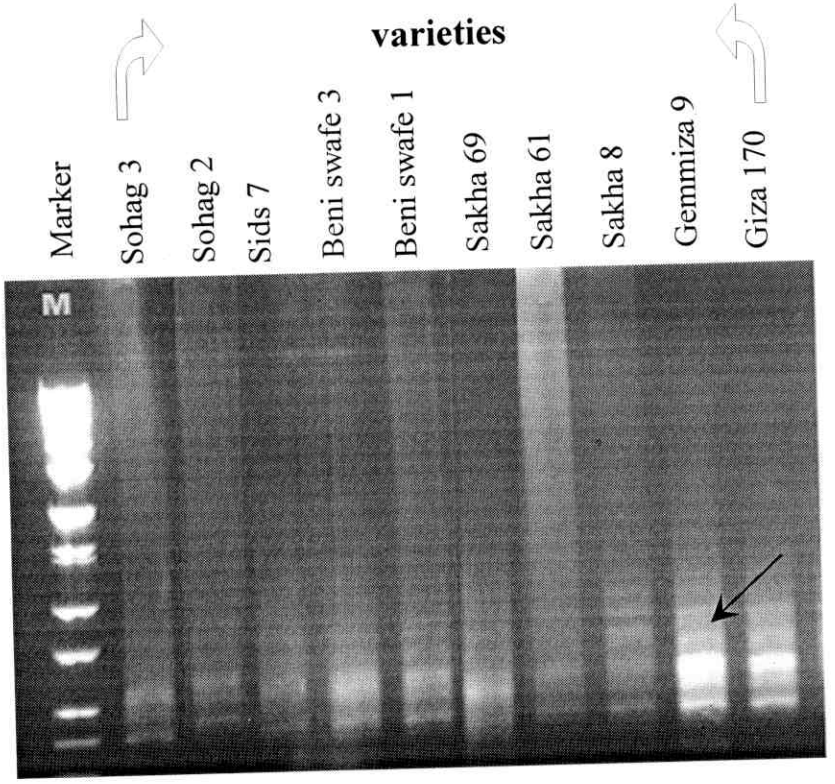


Figure (5): DNA polymorphism of the ten wheat cultivars using randomly amplified polymorphic DNA with the primer OP- A20

Table (9): DNA polymorphism using randomly amplified polymorphic DNA with the primer OP-A20

Band no.	MW	Cultivar									
		So. 3	So. 2	Si. 7	B.s 1	B.s 2	Sa. 69	Sa. 61	Sa. 8	Gem .9	G. 170
1	2710	0	0	0	0	1	0	0	1	1	1
2	2385	0	0	0	0	0	0	0	0	1	0
3	2060	0	0	0	0	1	0	0	1	1	1
4	1595	1	1	1	1	1	1	1	1	1	1
5	1330	0	0	0	1	1	1	0	0	1	1
6	1070	1	1	1	1	1	1	1	1	1	1

0 = absent band 1= present band Unique band

5-The primer OP- B17

The results of this primer are shown in Table (10) Figure (6). It exhibited a maximum seven amplification products with molecular sizes that ranged between 4630 bp to 595 bp. One common fragment which was noticed at 2080 bp in all cultivars. Cultivar Sakha 8 has one specific band at 4630 bp.

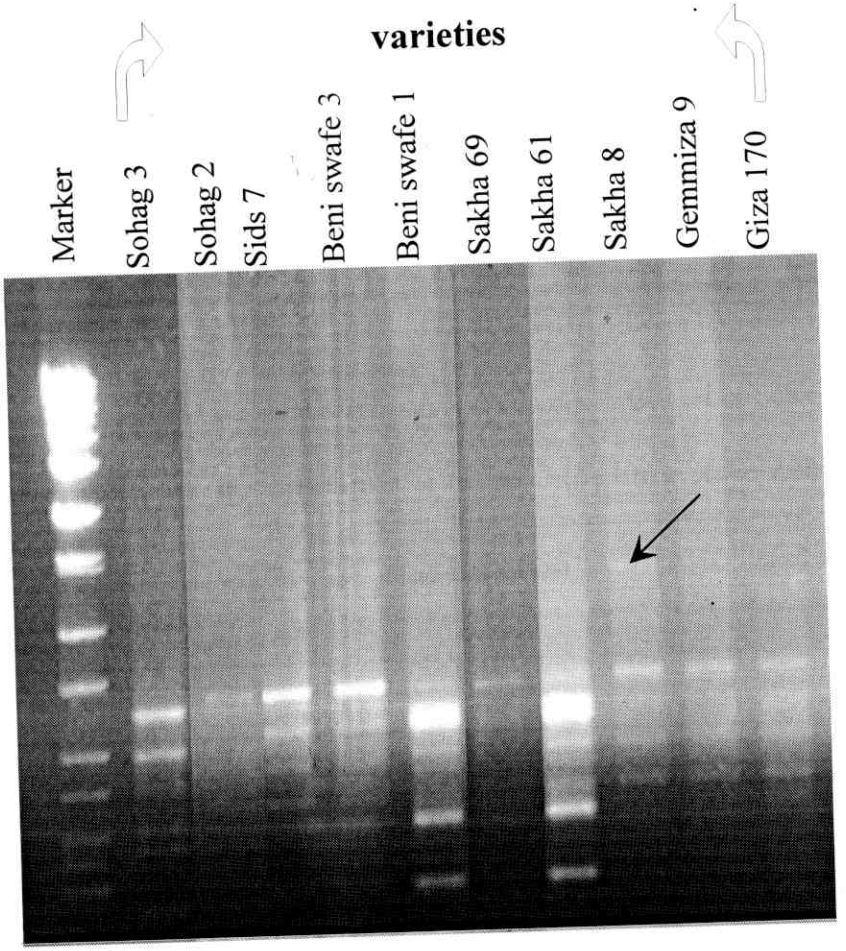


Figure (6): DNA polymorphism of the ten wheat cultivars using randomly amplified polymorphic DNA with the primer OP- B17

Table (10): DNA polymorphism using randomly amplified polymorphic DNA with the primer OP- B 17

Band no.	MW	Cultivar									
		So. 3	So. 2	Si. 7	B.s 1	B.s 2	Sa. 69	Sa. 61	S. 8	Gem. 9	G. 170
1	4630	0	0	0	0	0	0	0	1	0	0
2	2080	1	1	1	1	1	1	1	1	1	1
3	1560	1	1	1	1	0	1	0	0	0	0
4	1280	1	0	1	1	1	1	1	1	1	1
5	1260	0	0	0	0	1	0	1	0	0	0
6	925	1	0	1	1	0	0	1	1	1	1
7	595	0	0	0	0	1	0	1	0	0	0

0 = absence band 1= presence band Unique band

3.4.2. Genetic similarity and cluster analysis:

The RAPD data developed by all primers of this study were used to estimate the genetic similarity among the ten cultivars. The genetic similarity matrix based on all possible pairs of cultivars ranged from 10% to 94% (Table 11). The lowest genetic similarity value was between cultivar Sids 7 and Sakha 69 (similarity of 10%). While, the highest genetic similarity was noted between cultivar Sohag 2 and Gemmiza 9 (similarity of 94%).The other in between similarities could be detected from the data presented in (Table 11).

The dendrogram based on genetic similarities (Figure 7) divided the ten cultivars into two main clusters, four of the cultivars, Gemmiza 9, Giza 170 Sakha 61 and Sakha 8 were grouped in the first cluster. While, all of the other cultivars were grouped in to the second cluster, where the second cluster was separated into two sub- clusters. Where, cultivars Sohag 2 and Sohag 3 were grouped together in the same sub- cluster.

Table (11): Similarity matrix among ten wheat cultivars based on RAPD analysis

	So. 3	So. 2	Sids 7	B. s 3	B. s 1	Sa. 69	Sa. 61	Sa. 8	Gem. 9
Sohag 2	.706								
Sida 7	.294	.765							
Beni swafe 3	.353	.588	.176						
Beni swafe 1	.706	.706	.765	.588					
Sakha 69	.412	.765	.100	.176	.647				
Sakha61	.471	.588	.529	.471	.471	.647			
Sakha 8	.588	.471	.647	.588	.471	.765	.353		
Gemmiza 9	.471	.941	.647	.706	.588	.647	.706	.588	
Giza 170	.647	.927	.235	.412	.529	.235	..647	.529	.294

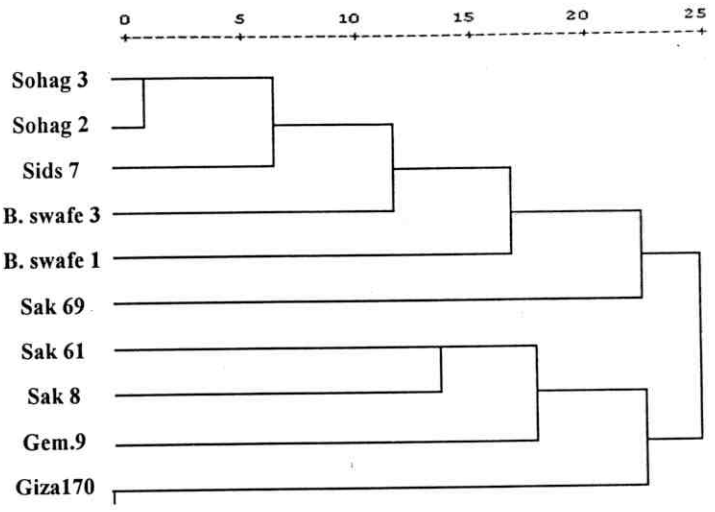


Figure (7): The genetic distances between the ten wheat cultivars based on RAPD analysis

The RAPD analysis seemed to be one of the effective tools for detecting polymorphism and could distinguish between all of the ten cultivars. These results agree with what was obtained by those of **Vierling and Nguyen (1992)** who reported that the RAPD technique was an excellent tool for monitoring and determining the genetic diversity present in all germplasm and in determining the genetic relationships among wheat genotypes. **Barkat *et al.* (2000)** used RAPD analysis to construct a similarity matrix and found that the genetic similarity among all the wheat cultivars ranged from 41% to 84%. These indicate that RAPD technique may help in studying genetic relationships between different wheat cultivars. **Guadognuolo *et al.* (2001)** reported that the best- resolved dendrogram was obtained using

RAPD data and it could detect the highest levels of genetic diversity in wheat. Also, **Bered *et al.* (2002)** found that, based on the use of RAPD marker, the average genetic similarity value among all genotype pars was 0.88, showing large genetic relationships in the wheat germplasm evaluated and the dendrogram showed efficiency in identifying genetic variability.