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Comparative Study between some Arabian Wheat Cultivars Based on Morphological and Yield Characteristics Growing in Egypt

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ABSTRACT

Wheat (*Triticum aestivum* L.) considers one of the world's major cereal crops and a major crop for human consumption with protein and carbohydrates. Four Arabian wheat, *T. aestivum* L. were collected from Egypt, Libya, Yemen and Iraq. Five cultivars from each country were used in the current study to evaluate these wheat cultivars under the Egyptian conditions based on morphological, biochemical and yield characteristics during 2021/2022 and 2022/2023 harvest seasons. Nine characters were selected, plant height (cm), number of tillers /plants, spikeletes number/spike, number of grains /spikes, 1000 grains weight, grain yield (kg/fed.), straw yield (kg/fed.), biological yield (kg/fed.) and harvest index (%). In addition, cluster analysis was used to detect the genetic distance and similarity among the tested wheat cultivars. The results indicated high significant differences among wheat cultivars in relation to plant height (cm). Concerning to tillers number per plant ranged from 2 and 2.40 as lowest mean for Mergawey, Kazeno (Libya) to 4.73 and 5.05 as the highest mean Acsad (Yemen) and Gemmeiza 9 (Egypt). Significant variations were observed between the different wheat cultivars in respect to spikeletes/spike. Results indicated that harvest index was linked to the morphological data. Our results indicated that more than ten wheat cultivars showed high harvest index ranged from 40 to 45.28% in both harvest seasons. Cluster analysis showed all the wheat cultivaes divided into two main groups with 90% gentic similirity, the first group includes the Egyptain wheat (Gemmeiza, 9) in separate cluster, while the second clusters includes all thye tested wheat cultivars in seperates groups. The second main cluster divided into two sub main groups with 93% similirity. Data from phlygentic and relationship showed the different between some arabian wheat and it could be used as indicater in the futuer breeding programes.

Keywords: Wheat, cultivars, Egypt, Libya, Yemen, Iraq, morphology, yield.

1. Introduction

Wheat (*Triticum aestivum* L.) is considered one of the main staple food crops produced globally (Collard *et al.,* 2005). More than 17% of the cultivated land and produced in a wide range of climatic environments systems, where and geographic regions (Gupta *et al.,* 2008; Filip *et al.*, 2023). It is the top cereal grain produced, consumed and exchanged in the world. Wheat (*Triticum aestivum)* is a main crop for human consumption. Wheat importance hinges upon exclusive rheological characters of wheat flour which let for the production baked goods (Chiran *et al.,* 2012; Mitura et al., 2023). Wheat (*Triticum aestivum)* ranks second crop after rice (*Oryza sativa*), providing 23.0 percent of dietary energy and acting as a staple food for 40.0 percent of the total human population worldwide (FAO, 2009). Jones *et al.* (1997) and Verma *et al.* (2024) reported that morphological markers which themselves are phenotypical traits and normally visually indicated phenotypic parameters. By 2050, the world population will reach 9 billion persons at the same time wheat and rice as fundamental crops production will be 59.1% & 19.8%, in respect, (United Nations report data, 2004). So, it's demanded to increase the grain production annual rate of 2 percent on the same area (Cassman, 1999).

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Rowntree, (1993) reported that the Egyptian wheat is considered a strategic product. Wheat provides more than 33% of the daily caloric intake of Egyptian consumers and 45% of total protein consumption. Wheat is also the main staple crop yielded in Egypt, occupying about 32.6 % of the planted crop area. In addation, in Yemen, wheat (*Triticum aestivum)* has been the earliest strategic food crop for over 7,000 years. Wheat (*Triticum aestivum)* in urban and Rural areas has provided its position as the fundamental staple food zones for bread making. Ancient Yemen utilized to grow the tetraploid wheat species (*T. pyramidale*) until hexaploidy bread wheat, (*Triticum aestivum)*, was presented from India almost in the early 20th century. Additionally, Iraq's arable area is projected by 8 m-hect. and only four to five m-hect. are being cultivated.

Winter wheat, rice and barley are the main cereal production. In Iraq almost 70-85 % of grown area focused on cereal grains. There are different varieties sown in Iraq and the yield averaged by 1.1 Ton/ha, whereas the world average is about 2.8 Ton/ha. (Abd-Alla and Bassiouny, 1994; Hassanein *et al*., 1997; Abdel-Ati and Zaki, 2006). The current study aims to study the various morphological and yield attributes amongst some Arabian wheat cultivars from Egypt, Libya, Yemen and Iraq.

2. Materials and Methods

The current research was done during the harvest season 2021/2022 and 2022/2023, respectively at Faculty of Agriculture, Egypt. A total of twenty wheat (*T. aestivum* L.) cultivars were used in the current study, five Egyptian wheat namely, Sakha-93, Giza-168, Gemmiza-9, Shakha-94 and Egypt-1; five Libyan wheat namely "Mergawey", "Sohag", "Kofra", "Kazeno" and "Kerem"; five Yemen wheat namely Behoth-14, Sonalica, Acsad, Kaaalhakl, and Local and five Iraqi wheat namely Al-Hashemeia, Al Rasheed, Behoth 22, Tamoz 3 and Sham 6. All grain samples were obtained from Field Crops Research Institute, Agricultural Researches center in each country.

2.1. Filed experiment

The experimental area was 10.5 m^2 (3x3.5 m) and seeding rate was 60 kg grains/fed., all grains for first season were sown on 15th November 2021. The first irrigation time (Almohya) was operated on 25 days of plants sowing, then the plants were watered every twenty-five days until the final stage. At harvest, 1 m^2 was selected randomly from each replicate to calculate the morphological, yield charters and yield components. At the next season (15th of November 2022), the parents were sown, and the morphological and yield characters were detected. The obtained results were analyzed according to the method of Gomez and Gomez (1984). In addition, the treatments' average were assessed using L.S.D. at 5% level of probability. Cluster analysis was used to detect the relationship and distance between tested cultivars.

2.2. Biochemical Studies

Three biochemical parameters were calculated for all wheat cultivars under the Alexandria conditions and physical, chemical properties of the experimental soil in 2021/2022 and 2022/2023 seasons were found in Table (1).

2.2.1. Hydrogen peroxide content

Tissue hydrogen peroxide content was examined at the same harvest day according to Cheeseman (2006).

23.2.2. Proline content

Free Proline Content in leaf was determined as described by Boctor (1971).

2.2.3. Activity of leaf peroxidase

Leaf peroxidase as the specific activity of leaf peroxidase (POX) was quantified according to Nathan and Cliff (2016).

Table 1: Some physical and chemical properties of the experimental soil in 2021/2022 and 2022/2023 seasons.

Soil properties	Season	
	2021/2022	**2022/2023**
A) Mechanical analysis:		
Clay%	39.0	37.0
Sand%	31.0	33.0
Silt%	31.0	30.0
Soil texture	**Clay loam soil**	
B) Chemical properties		
pH (1:1)	8.20	8.31
E.C. (ds/m)	3.80	3.70
1) Soluble cations (1:2) (cmol/kg soil)		
K^+	1.51	1.54
Ca^{++}	9.41	8.70
Mg^{++}	18.31	18.50
Na^{++}	13.51	13.80
2) Soluble anions (1: 2) (cmol/kg soil)		
$CO_3^{--} + HCO_3^-$	2.91	2.80
Cl^-	20.40	19.80
SO_4^{--}	12.51	12.60
Calcium carbonate (%)	6.51	7.00
Total nitrogen %	1.01	0.91
Available phosphate (mg/kg)	3.70	3.55
Organic matter (%)	1.41	1.40

3. Results and Discussion

3.1. Morphological characteristic

Wheat morphology and agronomic parameters have a special part in determining the status of each trait in increasing yield, therefore these characters were used in breeding programs to improve the yield and introducing commercial varieties (Mollasadeghi *et al*., 2011). Twenty wheat cultivars were selected from four different Arabian Countries were Egypt, Libya, Yemen and Iraq. All wheat cultivars were sown in two harvest seasons 2021/2022 and 2022/2023 in completely randomized design (RCDP) to study the Differentiation and relationships between the wheat cultivars based on morphological, yield and yield compounds as shown in Table (1). Nine characters were selected i.e. plant height (cm), tillers number/plant, spikelets number/spike, grains number/spike, 1000- grains weight, grain yield (kg/fed.), straw yield (kg/fed.), biological yield (kg/fed.) and harvest index (%). In addition to cluster analysis were used to detect the genetic distance and similarity between the tested wheat cultivars.

3.1.1. Plant height (cm)

Data in Table (1) explained high significant differences between the wheat cultivars in relation to plant height (cm). Data for the first harvest season indicated that five wheat cultivars showed the highest values were 117.0 cm (Kaaalhakl, Yemen), 113.0 cm (Behoth 14, Yemen), 108.9 cm (Gemmeiza 9, Egypt), 101.0 cm (Tamoz, Iraq) and 100.7 cm (Sonalica, Yemen). While, the Libyan wheat cultivar Kerem achieved the lowest plant height was 66.7 cm, forward by Kofra and Mergawey (Libya) by 70.3 and 73.1 cm, respectively as found in Table (1). Significant variations were observed between the wheat cultivars with $LSD_{0.05}$=8.21 for the first harvest season in average ranged from 66.7 cm to 117.0 cm. In the next harvest season, Kaaalhakl and Behoth 14 wheat cultivars (Yemen) and Gemmeiza 9 (Egypt) showed the highest plant height (cm) were 114.67, 110.67 and 106.57 cm, in respect and the other wheat cultivars plant height was less than 100 cm with $LSD_{0.05}$=11.0. The data detected no significant variations between the both harvest season in relation to plant height (cm). the lowest plant height in second harvest season was 64.37 cm to wheat cultivar Kerem (Libya) as recorded in Table (1).

3.1.2. Tillers number/plant

Concerning to stem number/ plant (tillers number) in wheat cultivars ranged from 2 and 2.40 as lowest mean to 4.73 and 5.05 tillers/plant as the highest mean for Mergawey, Kazeno (Libya), Acsad (Yemen) and Gemmeiza 9 (Egypt). According to the first harvest season Gemmeiza 9 showed the highest mean value (4.67 tillers/plant) forward by Acsad and Kaaalhakl by 4.33 tillers/plant and the lowest average was 2.0 tillers recorded to Mergawey and Kerem, while, in the second harvest seasons the maximum value was 5.07 (Gemmeiza 9) and some increase was observed for the Kazeno by 2.40 tillers/plant as found in Table (1). Based on analysis of variance in Table (1), that showed high significant variations in both seasons with $LSD_{0.05}$ was 0.56 and 0.77, in respect. The tillers number/plant had high correlation with spike number/plant and the final yield, so the increase in this charter will increase the whole yield in wheat cultivates.

3.1.3. Spikelets number/spike

In wheat, each spike contains three spikelets and the same location in the spike with 3-9 flowers, so the spikelet/spike considers an important indicator for the number of grains/ spike and the end product. Spikelets number/spike in wheat is fundamental character to detect the variation between wheat cultivars as presented in Table (1). Data observation in the first harvest season ranged from 13.5 spikelets/spike in Kerem wheat cultivar (Libya) to 23.8 spikelets/spike in Gemmeiza 9 (Egypt). In the first harvest season, the Egyptian wheat cultivars ranged from 17.3 spikelets/spike in Sakha 94 to n23.8 spikelets/spike for Gemmeiza 9; Libyan wheat cultivars ranged from 13.5 to 19.6 spikelets/spike; Yemeni wheat cultivars ranged from13 spikelets/spike (Local) to 22.33 spikelets/spike (Behoth14) and in final Iraqi wheat cultivars ranged from17.62 (Sham 6) to 21.5 spikelets/spike (Al Raseed), while in the next season, the values ranged from 14.47 spikelets/spike to 24.77 spikelets/spike for Kerem and Gemmeiza 9, respectively (Table, 1). Significant variations were observed between the different wheat cultivars in respect to spikelets/spike.

3.1.4. Grains number/spike

Correlation was found among the number of spikelet's and grain number/ spike between the tested wheat cultivars (Table, 1). High significant variations were found between the wheat cultivars. The Egyptian wheat cultivars ranged from 46.8 (Sakha 94) to 68.5 (Gemmeiza 9) by average was 57.65 grains/spike, while Libyan wheat was from 34.6 (Kerem) to 63.1 in Sohag; Yemeni wheat ranged from 42.3 (Behoth 14) and in Iraqi wheat ranged from 40.3 (Sham6) to 60.3 (Al Rasheed) as found in Table (1). High significant variations were observed between the different region with $LSD_{0.05}$ (4.10). From all wheat cultivars, Gemmeiza 9 showed the highest mean value (68.5) and the lowest was 34.6 in Kerem. In the next harvest season, the grain number/spike ranged from 34.3 (Kerem) to 68.2 grains/spike (Gemmeiza 9) with $LSD_{0.05}$ (3.71). No significant variations were observed between the two harvest seasons and the Egyptian wheat cultivars showed high values of grains number/ spike and the maximum value was 68.2 grain/spike and the lowest was 45.5 grains/spike; in Libyan wheat the minimum value was 34.3 grains and the maximum was 62.6 grains/spike; the Yemeni wheat cultivars , Behoth 14 recorded the highest value (61.9 grains/spike) and the lowest value was 42.0 (Kaaalhakl), also this cultivar showed the height plant height and number of tillers. For the Iraqi wheat cultivars data ranged from 43.7 to 57.7 grains/spike in Behoth 22.

3.1.5. 1000- grains weight (g)

Data in Table (1) for 1000 grains weight/cultivars (g) in both harvest seasons showed that Gemmeiza 9 and Egypt 1 have the highest value by an average of (64.3 and 63.48 g) tracked by Egypt 1 (52.7 and 51.83 g) in both harvest seasons, respectively. The results exhibited high significant difference among wheat cultivars for 1000- grains weight (g) from different countries. The Iraqi wheat values in the first season ranged from 36.3 (g) in Sham 6 cultivar to 53.5 (g) in Behoth 22; Yemeni wheat cultivars ranged from 29.5 (g) to 48.7 (g) for Kaaalhakl and Sonalica; Libyan wheat cultivars were from 41.3 (g) in Kerem to 58.5 (g) in Sohag and the Egyptian wheat cultivars ranged from 48.7 (g) in Sakha 94 to 64.3 (g) in Gemmeiza 9 (Table, 1). While the next harvest seasons the values were 35.34 to 52.53 (g); 28.63 to 47.83 (g); 40.43 to 57.63 (g) and 47.83 to 63.43 v(g), respectively as found in Table (1).

3.1.6. Grain yield (kg/fed.)

Data in Table (1) pointed the difference among the wheat cultivars for Grain yield kg/fed. High significant differences were observed among the wheat cultivars in relation to this character especially among the Egyptian and other wheat cultivars. The highest production per fedan was recorded to cultivars Gemmeiza 9 (Egypt), Sohag (Libya), Sonalica (Yemen) and Behoth 22 (Iraq) by 2972.8, 2106.1, 2040.6 and 2116.0 kg/fed in the first season and 2995.3, 2128.6, 2063.1 and 2138.5 kg/fed, in respect. While, the lowest cultivars were Sakha 93 (Egypt), Mergawey (Libya), Local (Yemen) and Sham 6 (Iraq) 1863.8, 1164.8, 1370.5, 1661.2; 1886.3, 1187.3, 1393.0 and 1683.7 kg/fed for both harvest seasons, in respect (Table, 1) and data showed no significant variations between both seasons with $LSD_{0.05}$ were 100.32 and 89.15.

3.1.7. Straw yield (kg/fed.)

Straw yield (kg/fedan) were determined as shown in Table 1. Analysis of variance presented high significant variations between the wheat cultivars used in the current study. High relationship was found between the grains yield/fed and straw yield/fed, Gemmeiza 9 (Egypt), Sohag (Libya), Sonalica (Yemen) and Behoth 22 (Iraq) by 3800.0, 2986.5, 2737.4 and 2786.0 kg/fed in the first season and 3734.23, 2920.73, 2671.63 and 2720.23 kg/fed, in respect. While, the lowest cultivars were Sakha 93 (Egypt), Mergawey (Libya), Local (Yemen) and Sham 6 (Iraq) 3328.1, 2001.0, 2126.3, 2501.2; 3262.33, 1935.23, 2060.53 and 2435.43 kg/fed for both harvest seasons.

3.1.8. Biological yield (kg/fed.)

The current results presented in Table 1 exhibited the same trend of the data, thus indicated that Gemmeiza 9 (Egypt), Sohag (Libya), Sonalica (Yemen) and Behoth 22 (Iraq) by 6772.8, 5092.6, 4778.0 and 4902.0 kg/fed in the first season and 6729.53, 5049.33, 4734.73 and 4858.73 kg/fed, in respect. The lowest biological yield was recorded to Mergawey (Libya) by 3165.8 and 3122.53 kg/fed for both harvest seasons.

3.1.9. Harvest index (%)

Harvest index (H.I.%) was determined for all the cultivars under study and these values were linked to the other morphological data which presented before. More than ten wheat cultivars showed high harvest index ranged from 40 to 45.28% in both harvest seasons. Data in Table (1) indicated that Tamoz 3 and Gemmeiza 9 recorded the highest values were 44.39, 43.89% in the first harvest season, while were 45.28 and 44.51% in the next season. In the first season the Egyptian wheat cultivars ranged from 35.90 to 43.89% by average was 39.89% and in the next season the average was 40.57%; in Libyan wheat cultivars the averages were 40.16 and 40.09%; Yemen wheat cultivars were 40.95 and 41.46% and Iraqi wheat cultivars were 41.45 and 42.43% (Table, 1).

These results are agreeing with Abdullah *et al.* (2015) who studied the different between Yemeni and Egyptian wheat cultivars and their results showed high significant differences among the Egyptian and Yemeni wheat cultivars in the morphological features. The Yemeni wheat cultivars were higher in seedling length (cm) with range 15.05 to 18.95 cm. also, Kaaalhakl was the highest one of by average 18.95 cm, followed by Local in average 18.68 18.68 cm, while Sonalica cultivar was the shortest one (15.04 cm). Concerning to the Egyptian wheat their data indicated significant values between the Sakha 93 and Giza 168 comparing with other cultivars. Also, our results in the same line with Idris *et al*. (2017) showed high significant variations between the Egyptian and Libyan wheat cultivars in relation to plant height (cm). Their data showed high values for all Egyptian wheat in both harvest seasons (2016 and 2017) comparing with Libyan wheats cultivars. Also, they reported that Gemmeiza 9 showed the highest plant height values were 103.4 and 100.4 cm in both seasons, respectively. These differences between wheat cultivars may be due to genetically differences make up between the three cultivars. Ahmed *et al*. (2011), Raisi Tohidi-Nejad (2012), Abo-Remaila and Abou El Enin (2017) found significant differences between wheat cultivars for plant height. Azra *et al*. (2005), Moghadam *et al*. (2012 found significant differences between wheat cultivars for spike length. These results are in accordance with El-Gizawy and Salem (2010), Ahmed *et al.* (2011), Raisi Tohidi-Nejad (2012), and Abo-Remaila and Abou El Enin (2017) who indicated that there were significant differences between wheat cultivars on number of spikelets/spikes.

Table 1: Plant attributes of twenty Arabian wheat cultivates under field condition, during 2021/2022 and 2022/2023 seasons.

Characters and Cultivars	Plant height (cm)	Tillers No./ plant	Spikelet No./ spike	Grains No./spike	1000-grain Weight (g)	Grain yield kg/fed.	Straw yield kg/fed.	Biol. yield kg/fed.	Harvest index %
Season 2021/2022									
Shakha93	93.7	2.67	17.9	45.8	52.1	1863.8	3328.1	5191.9	35.90
Geiza168	95.2	3.67	19.3	50.0	55.3	2054.5	3515.1	5569.6	36.89
Gemmeiza9	108.9	4.67	23.8	68.5	64.3	2972.8	3800.0	6772.8	43.89
Shakha94	102.3	3.00	17.3	46.5	48.7	1948.8	3192.1	5140.9	37.91
Egypt1	99.6	3.66	20.5	63.5	52.7	2142.8	3237.0	5379.8	39.83
Mergawey	73.0	2.00	18.0	45.6	49.5	1164.8	2001.0	3165.8	36.79
Sohag	94.6	3.67	19.6	63.1	58.5	2106.1	2986.5	5092.6	41.36
Kofra	70.3	2.33	16.4	45.5	47.4	1369.5	2320.8	3690.3	37.11
Kazeno	82.1	2.00	16.5	39.5	44.6	1464.5	1899.8	3364.3	43.53
Kerem	66.7	2.67	13.5	34.6	41.3	1185.0	1814.3	2999.3	39.51
Behoth14	113.0	3.00	22.33	62.3	44.3	1941.0	3091.5	5032.5	38.57
Sonalica	100.7	3.67	19.67	53.7	48.7	2040.6	2737.4	4778.0	42.71
Acsad	94.7	4.33	15.67	42.3	30.3	1461.8	2201.2	3663.0	39.91
Kaaalhakl	117.0	4.33	16.67	42.3	29.5	1396.8	2086.5	3483.3	40.10
Local	96.0	3.33	13.00	44.0	31.5	1370.5	2126.3	3496.8	39.19
AlHashemeia	98.3	2.9	18.3	43.5	41.7	1748.0	2791.1	4539.1	38.51
Al Rasheed	100.6	2.66	21.5	60.3	50.1	2042.4	3007.0	5049.4	40.45
Behoth 22	98.2	3.07	20.6	58.1	53.5	2116.0	2786.0	4902.0	43.17
Tamoz 3	101.0	3.00	18.61	50.6	46.4	2100.1	2630.4	4730.5	44.39
Sham 6	94.3	3.30	17.62	40.3	36.3	1661.2	2501.2	4162.4	39.91
L.S.D$_{=0.05}$	8.21	0.56	2.44	4.10	3.67	100.32	144.20	165.56	2.01
Season 2022/2023									
Shakha93	91.37	3.07	18.87	45.5	51.23	1886.3	3262.33	5148.63	36.64
Geiza168	92.87	4.07	20.27	49.7	54.43	2077.0	3449.33	5526.33	37.58
Gemmeiza9	106.57	5.07	24.77	68.2	63.43	2995.3	3734.23	6729.53	44.51
Shakha94	99.97	3.40	18.27	46.2	47.83	1971.3	3126.33	5097.63	38.67
Egypt1	97.27	4.06	21.47	63.2	51.83	2165.3	3171.23	5336.53	40.58
Mergawey	70.67	2.40	18.97	45.3	48.63	1187.3	1935.23	3122.53	38.02
Sohag	92.27	4.07	20.57	62.7	57.63	2128.6	2920.73	5049.33	42.16
Kofra	67.97	2.73	17.37	45.2	46.53	1392.0	2255.03	3647.03	38.17
Kazeno	79.77	2.40	17.47	39.2	43.73	1487.0	1834.03	3321.03	44.78
Kerem	64.37	3.07	14.47	34.3	40.43	1207.5	1748.53	2956.03	40.85
Behoth14	110.67	3.40	23.30	61.9	43.43	1963.5	3025.73	4989.23	39.35
Sonalica	98.37	4.07	20.64	53.4	47.83	2063.1	2671.63	4734.73	43.57
Acsad	92.37	4.73	16.64	42.0	29.43	1484.3	2135.43	3619.73	41.01
Kaaalhakl	114.67	4.73	17.64	42.0	28.63	1419.3	2020.73	3440.03	41.26
Local	93.67	3.73	13.97	43.7	30.63	1393.0	2060.53	3453.53	40.34
AlHashemeia	95.97	3.30	19.27	43.2	40.83	1770.5	2725.33	4495.83	39.38
Al Rasheed	98.27	3.06	22.47	59.9	49.23	2064.9	2941.23	5006.13	41.25
Behoth 22	95.87	3.47	21.57	57.7	52.63	2138.5	2720.23	4858.73	44.01
Tamoz 3	98.67	3.40	19.58	50.3	45.53	2122.6	2564.63	4687.23	45.28
Sham 6	91.97	3.70	18.59	40.0	35.43	1683.7	2435.43	4119.13	40.88
L.S.D$_{=0.05}$	11.0	0.770	2.72	3.71	3.41	89.15	154.52	168.60	1.66

3.2. Similirty and relationship between some Arabin wheat cultivars

Similirty and relationship between some arabin wheat cultivars was calcualted based on the morpholoical and yield characters for two harvest season as recorded in Figure 1 and Table 2. Cluster analysis in Figuer 1 showed all the wheat cultivaes divided into two main groups with 90% gentic similirity, the first group includrs the Egyptain wheat (Gemmeiza, 9) in separate cluster, while the second clusters includes all thye tested wheat cultivars in seperates groups.

The second main cluster divided into two sub main groups with 93% similirity. The sub cluster divdided into sub cluster with 94.5% and the first branch (97%) includes Kazeno (Libyia), while the

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other branch includes one cultivars from Libyia (Kofra) and three cultivars from Yemen were Acsad with Kofra at the sa,e cluster, Locl and Acsd were togather in one cluster (99%).

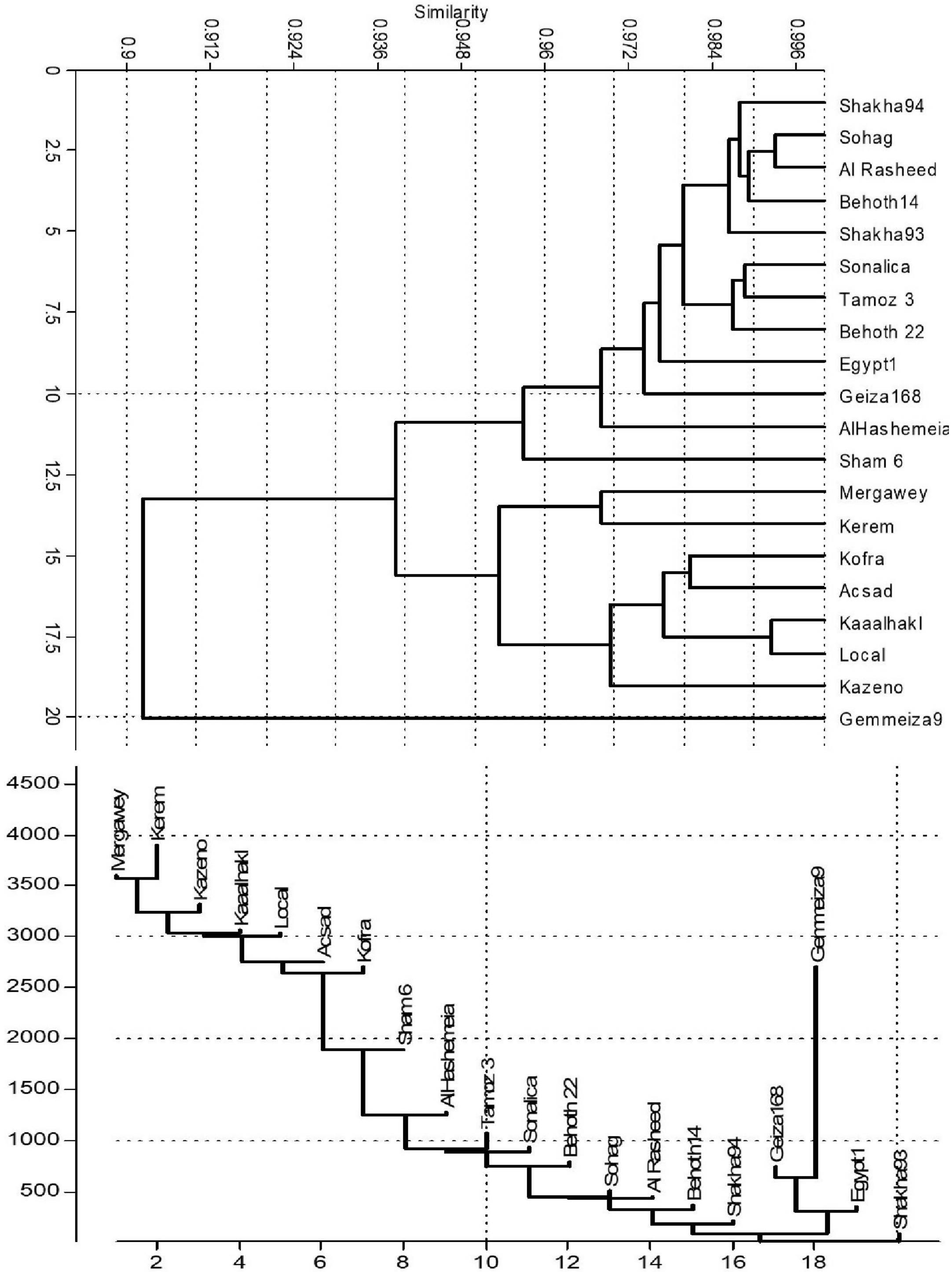

Fig. 1: Similarity and relationship between some Arabian wheat from Egypt. Libya, Yemen and Iraq growing in Egypt.

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Table 2: Matrix of similarity between the Egyptian, Libyan, Yemeni and Iraqi wheat growing under the Egyptian conditions

	Sa.93	**Gi.168**	**Ge.9**	**Sa.94**	**Eg.1**	**Me.**	**So.**	**Ko.**	**Kz.**	**Ke.**	**Be.**	**So.**	**Ac.**	**Ka.**	**Lo.**	**AlH.**	**AlR.**	**Be.**	**T.3**	**S.6**
Sa.93	1	0.965	0.867	0.986	0.972	0.761	0.965	0.832	0.789	0.734	0.974	0.940	0.829	0.804	0.807	0.933	0.967	0.946	0.929	0.890
Gi.168	**0.965**	1	0.902	0.958	0.974	0.728	0.950	0.799	0.756	0.702	0.948	0.924	0.795	0.771	0.774	0.898	0.950	0.930	0.914	0.856
Ge.9	0.867	**0.907**	1	0.864	0.886	0.640	0.859	0.707	0.666	0.616	0.854	0.829	0.704	0.682	0.683	0.803	0.855	0.841	0.823	0.762
Sa.94	0.986	0.958	**0.863**	1	0.976	0.765	0.978	0.837	0.793	0.739	0.987	0.954	0.833	0.809	0.812	0.938	0.981	0.959	0.943	0.895
Eg.1	0.972	0.974	0.886	**0.979**	1	0.743	0.972	0.814	0.771	0.717	0.966	0.941	0.811	0.787	0.789	0.915	0.968	0.954	0.935	0.872
Me.	0.761	0.728	0.640	0.765	**0.743**	1	0.769	0.924	0.953	0.967	0.773	0.799	0.925	0.948	0.947	0.823	0.773	0.787	0.803	0.864
So.	0.965	0.950	0.859	0.9784	0.972	**0.769**	1	0.840	0.797	0.742	0.982	0.967	0.837	0.812	0.815	0.941	0.992	0.979	0.962	0.899
Ko.	0.832	0.799	0.707	0.834	0.814	0.924	**0.840**	1	0.939	0.897	0.845	0.871	0.980	0.963	0.970	0.896	0.844	0.858	0.876	0.938
Kz.	0.789	0.756	0.669	0.793	0.771	0.953	0.797	**0.939**	1	0.941	0.802	0.828	0.955	0.969	0.964	0.852	0.801	0.815	0.833	0.894
Ke.	0.734	0.702	0.616	0.734	0.717	0.967	0.742	0.897	**0.941**	1	0.74761	0.772	0.899	0.921	0.92	0.797	0.746	0.760	0.777	0.838
Be.	0.974	0.948	0.854	0.982	0.966	0.773	0.982	0.845	0.802	**0.747**	1	0.963	0.842	0.82	0.820	0.947	0.989	0.968	0.952	0.904
So.	0.94063	0.924	0.829	0.952	0.941	0.799	0.967	0.871	0.82808	0.772	**0.963**	1	0.868	0.844	0.846	0.967	0.972	0.986	0.988	0.930
Ac.	0.829	0.795	0.704	0.835	0.811	0.925	0.837	0.980	0.955	0.899	0.842	**0.868**	1	0.973	0.976	0.894	0.841	0.855	0.873	0.936
Ka.	0.8044	0.771	0.682	0.809	0.787	0.948	0.812	0.963	0.969	0.921	0.82	0.844	**0.973**	1	0.992	0.869	0.817	0.831	0.849	0.911
Lo.	0.807	0.774	0.683	0.812	0.789	0.947	0.815	0.970	0.964	0.921	0.820	0.846	0.976	**0.992**	1	0.872	0.819	0.833	0.851	0.914
AlH.	0.933	0.898	0.803	0.938	0.915	0.82365	0.941	0.896	0.852	0.797	0.947	0.967	0.894	0.869	**0.872**	1	0.946	0.960	0.961	0.956
AlR.	0.967	0.950	0.855	0.981	0.968	0.773	0.992	0.844	0.801	0.746	0.989	0.972	0.841	0.817	0.819	**0.946**	1	0.977	0.961	0.903
Be.	0.946	0.930	0.841	0.959	0.954	0.787	0.979	0.858	0.815	0.760	0.968	0.986	0.855	0.831	0.833	0.960	**0.977**	1	0.981	0.917
T.3	0.929	0.914	0.823	0.943	0.935	0.803	0.962	0.876	0.833	0.777	0.952	0.988	0.873	0.849	0.851	0.961	0.961	**0.981**	1	0.935
S.6	0.890	0.856	0.762	0.895	0.872	0.864	0.899	0.938	0.894	0.838	0.904	0.930	0.936	0.911	0.914	0.956	0.903	0.917	**0.935**	1

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The second branch of this cluster diccided into two clusters from Libyia with 96.9% (Mergawey and Kerem). The second main sub cluster divided at 93.5% into sub two groups includes Sham 6 (Iraq) in indivadual one by 95.8%, and the other branch includes some wheat from different atrabian cantures such as: Geiza 168 (97.5%), Egypt 1 (97.8%), Behoth 22(98.5%), Sonalica (Yemen) and Tamoz 3 (Iraq) togarther by 98.7% and Sakha 93, Behoth 14, AlRasheed, Sohag and Sakha 94 togatrher by 98.8% (Figuer 1).

Data in Figuer (1 and 2) reported that the Egyptian wheat were nerably expect Gemmeiza 9, forwed by Behoth 14, AlRaheed, Sohag,then in the uper one were Behoth 22, Sonalic, Tamoz 3, then Alhashemi, Sham6, while the final were Kofra, Acsad and all of Local, Kaaalkha, Kazeni and Mergawey as found in Figuer 1.

Matreix and similirty in Table (2) showed that the percentage of similirty between the tested wheat cultivars ranged from 0.747% to 0.992%. for the Egyptian wheat the range were from 0.734 to 0.979%; Libyian wheat ranged from 0.747 to 0.939%; Yemeni wheat cultivars ranged from 0.872 to 0.973 and finally, Iraqi wheat ranged from 0.872 to 0.977%.

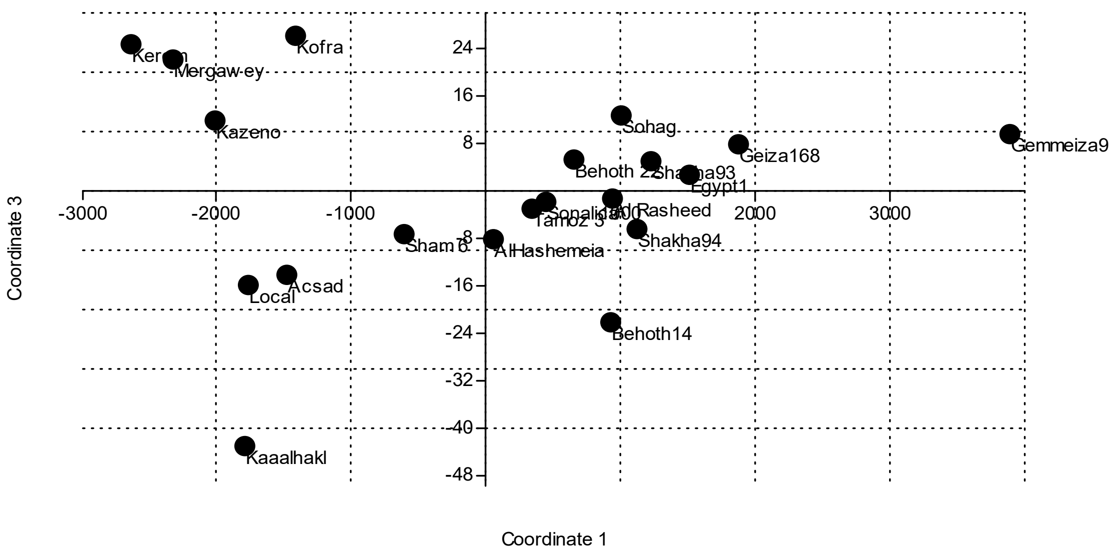

Fig. 2: Genetic distance and similarity between some Arabian wheat from Egypt. Libya, Yemen and Iraq growing in Egypt.

3.3. Biochemical studies

3.3.1. Hydrogen peroxide content (H_2O_2 content)

Root H_2O_2 content (µmol g FW^{-1}) exhibited an increase in some wheat cultivars due to their salt tolerant such as Gemmeiza9, Egypt1 (Egypt); Sohag, Kofra (Libya), Behoth14, Kaaalhakl (Yemen) and Al-Rasheed, Behoth 22 (Iraq) by means were 34.11, 31.01, 31.50, 30.30, 30.22, 30.40, 32.01and 31.50 µmol g FW^{-1} while other wheat cultivars showed low level of H_2O_2, for examples Shakha93, Mergawey, Sham 6, Tamoz 3, Local, Kerem and Kazeno as presented in Table 3. The highest value was 34.11 µmol g FW^{-1} in cultivar Gemmeiza 9 due to line pedigree and growing condition of plant area which it originated forward by other wheat cultivars.

3.3.2. Leaf Proline content

Free Proline content was higher within leaf tissue of wheat cultivates namely Gemmeiza9 (182.4 µg g FW-1), Egypt1 (136.0 µg g FW-1) (Egypt); Sohag (145.0 µg g FW-1), Kofra (166.8 µg g FW-1) (Libya), Kaaalhakl (152.4 µg g FW-1) (Yemen) and Al-Rasheed (192.1 µg g FW-1), Behoth 22 (183.0 µg g FW-1) (Iraq) compared to others wheat cultivars were 91.32, 99.00, 101.0 and 117.0 µg g FW-1 for Behoth14, Sonalica (Yemen), Shakha 93 (Egypt) and Mergawey (Libya) as found in Table (3). The highest value was 192.1 µg g FW^{-1} in cultivar Al Rasheed forward by Behoth 22 by 183.0 µg g FW^{-1}.

3.3.3. Activity of leaf POX

A noticeable increase in the specific activity of leaf peroxidase was observed as wheat cultivars Gemmeiza 9, Egypt1(Egypt), Mergawey, Sohag, Kofra (Libya), Kaaalhakl (Yemen), Al Rasheed and Behoth 22 (Iraq) by values were 7.86, 6.46, 7.04, 6.92, 5.71, 7.39 and 7.04 UMg^{-1} protein compared with other cultivars (Table, 3). The specific activity of leaf POX for wheat cultivars were ranged from 3.81 to 7.86 UMg^{-1} proteins. The highest wheat cultivar value was Gemmeiza-9, and the lowest value was Sonalica. Different experiments reported that total POX activity will decrease in response to salinity stress (Sairam *et al.* 2002; Meloni *et al*. 2003; Mittova *et al*. 2004). Peroxidases are enzymes related to polymer synthesis in cell wall as well as in the prevention of oxidative damage caused by environmental stress to the membrane lipids.

Table 3: Leaf H_2O_2 content, Leaf Proline and Leaf POX content of wheat cultivars.

Barely cultivars and lines	Leaf H_2O_2 content (µ mol g FW^{-1})	Leaf proline content (µg g FW^{-1})	Leaf POX (U Mg^{-1} protein)
Shakha 93	19.50	101.0	3.88
Geiza168	24.60	129.6	5.14
Gemmeiza 9	34.11	182.4	7.86
Shakha 94	21.51	135.0	5.19
Egypt 1	31.01	136.0	6.46
Mergawey	19.50	117.0	4.50
Sohag	31.50	145.0	7.04
Kofra	30.30	166.8	6.92
Kazeno	22.00	132.0	5.08
Kerem	21.00	126.0	4.85
Behoth 14	30.22	91.32	3.51
Sonalica	26.50	99.00	3.81
Acsad	28.72	112.3	4.32
Kaaalhakl	30.40	152.4	5.71
Local	23.21	139.3	4.66
AlHashemeia	29.40	111.4	4.28
Al Rasheed	32.01	192.1	7.39
Behoth 22	31.50	183.0	7.04
Tamoz 3	22.10	136.6	4.56
Sham 6	23.71	128.3	4.86

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