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Agro-morphological diversity of some accessions of bread wheat (*Triticuma aestivum*) in western Algeria

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Abstract. *Bellatreche A, Mahdad MY, Kaouadji Z, Gaouar* SBS*. 2017. Agro-morphological diversity of some accessions of breadwheat (*Triticum aestivum*) in western Algeria. Biodiversitas 18: 409-415.* The diversity of wheat in Algeria is well known. An inventory has been conducted in the west of Algeria (North and South) to collect local accessions of bread wheat *Triticuma aestivum* for their morphological characterization. In this context, a collection of 23 traditional and new accessions of bread wheat was investigated using nine quantitative agro-morphological traits. The phenotypic diversity was determined by the Shannon-Weaver diversity index (H') at different levels (sample Totality which is by type of wheat and varietal name). The H' showed a wide phenotypic variability for different traits with H' average of 0.59. The results of the multiple correspondence analysis and hierarchical clustering showed a clear distinction between different accessions. The results of this work have revealed the great phenotypic diversity of wheat accessions. These accessions were partially matched the names of varieties because of the existence of homonyms and synonyms in the names given by farmers. The results showed that these local accessions (that genetic composition should be studied more precisely) are mainly cultivated by traditional farmers who conserve this genetic resource, often on very small plots in the oases or in an inaccessible terrains.

Keywords: Algeria, morphological diversity, morphological traits, *Triticuma aestivum*

INTRODUCTION

Algeria is having a chronic dependence on cereals including wheat. The promotion of new culture in our country in order to reduce this dependence has not produced the desired results, as far as growing techniques and technical route are concerned, the new culture is not respected by farmers and finally, again, we will face the inadequacy of varieties, soil conditions, crop and the environment. Considered as one of the largest consumers of cereals in the world, and facing population growth, the Algerian government and breeders found themselves obliged to develop and introduce improved varieties with high yield adapted to intensive grain system, such as Arz and HD 1220 or Hiddab that represent a very high percentage of wheat plantings.

Biodiversity is the basis of several breeding programs to create varieties adapted to different topographic and climatic constraints (Bellon et al. 1996; Kebebew et al. 2001). Quantification and phenotypic characterization of this material is an important preliminary step to quantify genetic erosion over time due to climate changes and replacement of traditional accessions by modern varieties (Belaid 2000) and suggest strategies in maintaining and valuing diversity (Jarvis 1999). These steps can estimate the existing diversity for the studied material (Schut et al. 1997), and suggest appropriate plans for the management and improvement of genetic resources.

Many studies have thus focused on the characterization of traditional accessions based on agro-morphological characters (Al Khanjari et al. 2008; Teklu and Hammer 2008; Surur and Amara-Hajer 2009; Zarkti et al. 2012; Geleta and Grausgurber 2013), and on molecular characterization (Zarkti et al. 2010; Peleg et al. 2011; Oliveira et al. 2012; Rekha Malik et al. 2013; Medini et al. 2014).

This work is only a continuity to the work done during the 2009-2010 as a companion for the study of some phenotypic traits of agronomic interest in the *Wilaya* (region) of Tlemcen (Bellatreche 2011) and the analysis of the diversity of these varieties and the influence of the environment on their performance (Bellatreche and Gaouar 2012).

MATERIALS AND METHODS

Vegetal material and collection sites

Our study is based on the characterization of the diversity of bread wheat (*Triticuma aestivum* L.). The plant material is characterized by a survey on land, during the year 2014-2015 in the Algerian western regions (Figure1).

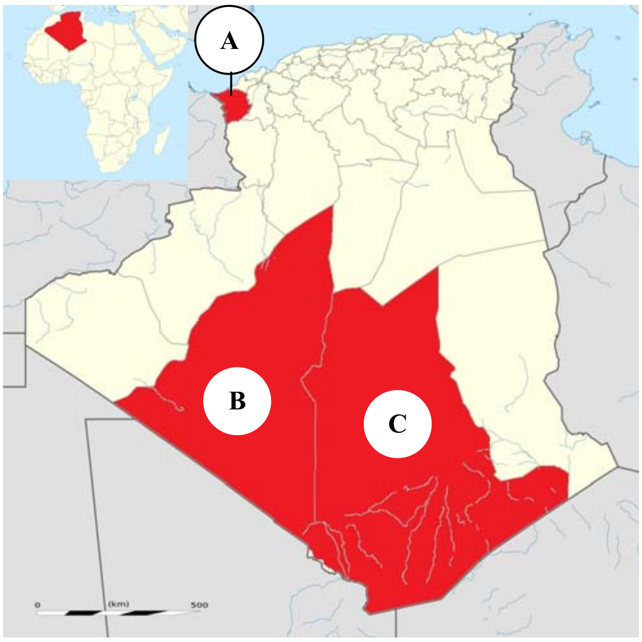

Figure 1. Location of different farmers' fields collection sites in western Algeria. A. Tlemcen, B. Adrar, C. Tamanrasset

In total six hundred and ninety (690) spikes of wheat were the subjects of this study. These spikes were collected from fifteen (15) localities belonging to different sites in the study area (Table 1). To better meet the objectives of our study, twenty-three (23) farmers were asked to give their ideas on agricultural practices, types and names of bread wheat accessions grown.

Our collection was cultivated at 23 fields; each population of the study completed the harvest of 30 different plants randomly taken in the field. The survey of land was carried out in three areas to describe the types of agro-systems in which changes local accessions of wheat, and to assess the impact of agricultural practices on the management of diversity of wheat.

During the crop year, the accessions were evaluated using nine characters having variations of quantitative type. These characters are: plant height (PH), stem length (SL), spike length with beard (SLWB), spike length without beard (SLWtB), width of spike (WdS), weight of spike (WtS), length of beards (LB), number of seeds per spike (Nbr S/S), and weight of seeds per spike (W S/S). The morphological characterization of the accessions was conducted according to international standards, particularly those of the International Plant Genetic Resources Institute (IPGRI 1985), currently named Biodiversity International and Protection Union of New Varieties of Plants (UPOV 1988).

Statistical analyses

After transferring data over a matrix, several statistical tests were carried out by the R software (version R-2.15.3).

Shannon and Weaver Index

Before performing this test a transformation of quantitative traits in classes was performed. This transformation was performed with the "summary" of the R software which divides the range of values in the desired number of classes (four), and determines the limits of each class. The frequencies of different phenotypic classes for each trait in each of the three collection areas and in four

Table 1. Number and origin of accessions studied in western Algeria

Region	Locations	Localites	Longitudes	Latitudes	Altitudes
Tlemcen	Mahon Demias	Merbah	1°01'56.75"O	34°54'17.98"N	702 m
	Arz Ramd Am	Amieur	1°17'51.26"O	34°55'13.08"N	583 m
	HD Maghnia	Maghnia	1°44'05.73"O	34°51'13.78"N	411 m
	HD Hamadouche	Tlemcen	1°17'51.26"O	34°55'13.08"N	583 m
	Arz A/Fezza	Ain Fezza	1°14'05.92"O	34°52'37.23"N	858 m
	ArzFP/Hamadouche	Tlemcen	1°17'51.26"O	34°55'13.08"N	583 m
	HD FP S/Abdelli	SidiAbdelli	1°07'58.53"O	35°03'50.71"N	464 m
Adrar	ZraaLabled	ZaouiatAbd El Kader	0°14'18.29"E	29°15'41.81"N	288 m
	Belmabrouk	Zaouia	0°14'18.29"E	29°15'41.81"N	288 m
	El Hamra	Zaouia	0°14'18.29"E	29°15'41.81"N	288 m
	Bahamoud	Zaouia	0°14'18.29"E	29°15'41.81"N	288 m
	Belmabrouk d3	ZaouiatKounta (El Mnasir)	0°12'00.52"E	27°13'00.28"N	189 m
	Belmabrouk d5	Tamantit (SidiYoucef)	0°16'00.19"E	27°46'00.31"N	241 m
Tamanrasset	Bent M'barak	Tazrouk	6°15'40.92"E	23°25'17.12"N	1814 m
	El Hamra Ig	Iglen	4° 51′ 0″ E	22° 52′ 59.88″ N	1 400 m
	El Baydha Ig	Iglen	4° 51′ 0″ E	22° 52′ 59.88″ N	1 400 m
	Manga Am	Ganet Ain Amguel	3°25'19.93"E	24°32'28.27"N	633 m
	El HamraTz	Tazrouk	6°15'40.92"E	23°25'17.12"N	1814 m
	Manga Tz	Tazrouk	6°15'40.92"E	23°25'17.12"N	1814 m
	Labyadh Id	Idless	5°56'03.64"E	23°49'03.80"N	1398 m
	LabyadhTz	Tazrouk	6°15'40.92"E	23°25'17.12"N	1814 m
	Manga Baydha	Idless	5°56'03.64"E	23°49'03.80"N	1398 m
	H'bircha	Ain Amguel	3°25'19.93"E	24°32'28.27"N	633 m

classes were calculated for each line. Based on these frequencies, the index of Shannon-Weaver (Shannon and Weaver, 1948) which was described by Jain et al. (1975), was calculated for each line in order to estimate the phenotypic class.

The Shannon-Weaver index is calculated using the following formula:

$$H = -\sum_{i=1}^{n} Pi \, Ln \, Pi$$

H = Shannon and Weaver diversity index

Pi = Frequency of each phenotypic class *i* of a given character

n = Number of phenotypic classes of each character

The index (H) is converted towards the relative phenotypic diversity index (H ') by dividing it with its maximum value: H max (Ln (n)) to obtain 0 to 1 values.

$$H' = -\sum_{i=1}^{n} Pi \, Ln \, Pi / Ln(n)$$

The relative diversity index (H ') reaches its minimum value, which is zero for monomorphic characters. Moreover, the value of this index increases with the degree of polymorphism and reaches a maximum value (1) when all the phenotypic classes present in equal frequencies.

Analysis of variance (ANOVA)

Analysis of variance was used to calculate variation among accessions, using the R software (version R-2.15.3).

Principal components analysis (PCA)

Principal components analysis was carried out on the correlation matrix. It calculated the mean data of accessions using the FactoMineR software (version R-2.15.3).

Hierarchical Ascendante Classification (HAC)

Hierarchical Ascendante Classification or cluster analysis, was used to calculate the mean data of accessions using the FactoMineR software (version R-2.15.3) to better classify the 23 accessions of bread wheat.

RESULTS AND DISCUSSION

Relative diversity index of different characters

The relative diversity index (H' moyen) of all studied accessions is about 0.59 (Table 2). This index ranges from 0.19 to 0.82 respectively for the varieties El Hamra and Manga. This index ranges from 0.46 of spike length with beard and length of beards and 0.85 for the width of the spike (Table. 2).

According to all the features and all varieties: the highest diversity index (H '= 0.98) is of seeds per spike weight of the Manga variety at Tazrouk region. The highest diversity indices (H'≥0, 60) are obtained from thirteen accessions, intermediate values (0, 40≤H <0.60) were obtained from eight accessions, and the lower diverse values (0, 10≤H <0.40) were observed from two accessions.

Relative index diversity of different characters depending on the region (Tlemcen, Tamanrasset and Adrar)

The index of Shannon and Weaver was calculated from the different characters in the three regions surveyed are: Tlemcen, Tamanrasset and Adrar (Table 2.). The Tlemcen region experienced an average diversity index of about 0.49, followed by the region of Tamanrasset (average H' = 0.57) and that of the region of Adrar (average H'= 0, 64).

After that we have calculated the diversity index of S.W; by using “ANOVA” for different values, we found in the results (table 3) that; (i) The average number of grain per spike character among different accessions ranges from 19.67 seeds / spike for Mahon Demias (Tlemcen) to 87.8 seeds / spike for Manga Baydha (Tamanrasset). (ii) The average of character width of spike varies from 0.83 cm for El Hamra (Adrar) to 1.65 cm for Arz in Ain Fezza (Tlemcen). (iii) The average spike weight character varies from 1.05 g for El Hamra in region of Iglen (Tamanrasset) to 4.67 g for Manga Baydha (Tamanrasset). (iv) The average seed’s weight per spike varies from 0.50 g for El Hamra in region of Iglen (Tamanrasset) to 3.34 g for the Manga Baydha (Tamanrasset). (v) Significance analysis of the production traits was performed by $\chi 2$-test ($P < 0.05$), using R statistical software. The significance of the number of seed/spike, width of spike, weight of spike and weight of seed/ spike are analyzed using the ANOVA and Tukey Test ($P < 0.05$) with R statistical software.

From table 4, it is known that (i) The average of the plant’s height trait varies from 52.32 cm for El Hamra in Iglen region (Tamanrasset) to 125.10 cm for Labyadh in Idles (Tamanrasset). (ii) The average length of the spike’s without beards character ranges from 5.77 cm for El Hamra in Iglen (Tamanrasset) to 14.72 cm for HD Maghnia (Tlemcen). (iii) The average length of the beard’s character ranges from 0.83 cm for H'bircha (Tamanrasset) to 7.30 cm for HD in the region of Sidi Abdelli (Tlemcen). (iv) The average length of the character of the spike with barbs ranges from 6.35 cm for Bent M'barak (Tamanrasset) to 18.67 cm HD for the region Maghnia (Tlemcen). (v) The average length of the spike’s with beards character varies from 45.45 cm for El HamraIglen (Tamanrasset) to 116.20 cm for Labyadh at the Idles area (Tamanrasset). (vii) Significance analysis of the adaptative characters was performed by $\chi 2$-test ($P < 0.05$), using R statistical software. The significance of the plant height, Spike length without beards, length of beards, Spike length with beards and Stem length are analyzed using the ANOVA and Tukey Test ($P < 0.05$) with R statistical software.

We take note that at Figure 2, the PCA of bread wheat accessions (which sets apart the character stem length) is reflecting a high level of statistical significance. We also note that PCA represents 71.44% of the information used for statistical processing and it is very significant.

Table 2. Relative diversity index of different characters and accessions of bread wheat in western Algeria

Accessions	PH H'	SL H'	SLWB H'	SLWtB H'	WdS H'	WtS H'	LB H'	Nbr S/S H'	W S/S H'	Average
Tlemcen										
MahonDemias	0.79	0.73	0.19	0.76	0.58	0.23	0.00	0.00	0.23	0.42
ArzRamd Am	0.68	0.64	0.39	0.75	0.78	0.76	0.36	0.77	0.75	0.69
HD Maghnia	0.49	0.63	0.00	0.00	0.11	0.33	0.36	0.11	0.33	0.26
HD Hamadouche	0.58	0.82	0.00	0.00	0.36	0.58	0.42	0.57	0.59	0.45
Arz A/Fezza	0.76	0.84	0.56	0.91	0.36	0.81	0.23	0.67	0.75	0.67
Arz FP/Hamadouche	0.78	0.70	0.49	0.94	0.76	0.74	0.00	0.70	0.74	0.68
HD FP S/Abdelli	0.78	0.75	0.00	0.42	0.50	0.28	0.00	0.49	0.36	0.42
Avr Tlemcen region	0.70	0.73	0.23	0.54	0.49	0.53	0.20	0.47	0.54	0.49
Adrar										
ZraaLabled	0.49	0.43	0.59	0.70	0.71	0.86	0.77	0.44	0.75	0.67
Belmabrouk	0.72	0.72	0.43	0.66	0.50	0.49	0.77	0.67	0.49	0.63
El Hamra	0.80	0.80	0.62	0.67	0.46	0.23	0.49	0.46	0.39	0.57
Bahamoud	0.47	0.44	0.55	0.57	0.79	0.71	0.57	0.67	0.76	0.65
Belmabrouk d3	0.71	0.65	0.63	0.49	0.89	0.68	0.64	0.76	0.73	0.72
Belmabrouk d5	0.70	0.68	0.59	0.73	0.63	0.78	0.78	0.81	0.76	0.75
Avr Adrar region	0.65	0.62	0.57	0.64	0.66	0.63	0.67	0.64	0.65	0.64
Tamanrasset										
Bent M'barak	0.47	0.49	0.28	0.39	0.73	0.75	0.41	0.63	0.68	0.57
El Hamra Ig	0.00	0.00	0.42	0.11	0.49	0.11	0.18	0.23	0.00	0.19
El Baydha Ig	0.11	0.11	0.67	0.69	0.68	0.69	0.64	0.49	0.23	0.51
Manga Am	0.58	0.82	0.43	0.68	0.69	0.74	0.42	0.78	0.72	0.68
El HamraTz	0.76	0.78	0.59	0.77	0.78	0.58	0.72	0.65	0.58	0.72
Manga Tz	0.65	0.60	0.70	0.59	0.90	0.95	0.66	0.96	0.98	0.82
Labyadh Id	0.00	0.00	0.67	0.69	0.94	0.96	0.42	0.93	0.96	0.66
LabyadhTz	0.64	0.73	0.64	0.68	0.79	0.93	0.79	0.82	0.80	0.79
Manga Baydha	0.64	0.63	0.55	0.74	0.23	0.18	0.63	0.11	0.23	0.45
H'bircha	0.91	0.93	0.64	0.67	0.43	0.36	0.23	0.53	0.46	0.59
Avr Tamanrasset région	0.48	0.51	0.56	0.60	0.67	0.62	0.51	0.61	0.56	0.57
Average	0.59	0.60	0.46	0.59	0.61	0.60	0.46	0.58	0.58	0.59

Table 3. Averages and SD production traits of bread wheat accessions of bread wheat in western Algeria

Accession	Number of seed/spike*	Width of spike (cm)*	Weight of spike (g)*	Weight of seed/ spike (g)*
Arz A/Fezza	37.9±1.36 ^{def}	1.65±0.05 ^{k}	1.71±0.12 ^{ac}	1.22±0.07 ^{bde}
Arz FP/Hamadouche	41.03±1.65 ^{efg}	1.28±0.04 ^{egh}	2.42±0.11 ^{dfg}	1.71±0.08 ^{dfg}
ArzRamd Am	35.17±1.77 ^{cde}	1.28±0.04 ^{efi}	1.95±0.1 ^{bcde}	1.40±0.08 ^{cdf}
Bahamoud	32.43±1.49 ^{be}	1.02±0.03 ^{bcd}	1.60±0.03 ^{ac}	1.20±0.07 ^{bd}
Belmabrouk d3	42.17±1.36 ^{efg}	1.14±0.03 ^{def}	2.08±0.09 ^{cf}	1.54±0.07 ^{cdf}
Belmabrouk d5	40.33±1.64 ^{efg}	1.31±0.03 ^{fgi}	2.28±0.1 ^{cfg}	1.77±0.08 ^{fg}
Benmabrouk	60.67±2.76 ^{ij}	1.45±0.03 ^{hij}	3.86±0.19 ^{ij}	2.77±0.14 ^{ij}
Bent M'barak	28.8±1.23 ^{abd}	1.14±0.03 ^{def}	1.94±0.12 ^{bcde}	1.16±0.06 ^{bc}
El Baydha Ig	22.2±1.71 ^{ab}	1.11±0.03 ^{de}	1.38±0.12 ^{ab}	0.54±0.08 ^{a}
El Hamra	26.07±0.96 ^{abc}	0.83±0.03 ^{a}	1.14±0.05 ^{a}	0.84±0.04 ^{ab}
El Hamra Ig	21.57± 0.97 ^{ab}	0.86±0.02 ^{ab}	1.05±0.05 ^{a}	0.50±0.03 ^{a}
El Hamra Tz	37.47±2.36 ^{def}	1.04±0.03 ^{cd}	1.95±0.08 ^{bcde}	1.39±0.06 ^{cdf}
H'bircha	65.77±3.47 ^{j}	1.61±0.05 ^{jk}	4.10±0.24 ^{jk}	3.06±0.2 ^{jk}
HD FP S/Abdelli	54.7±0.63 ^{hi}	1.41±0.02 ^{gi}	3.29±0.04 ^{hi}	2.35±0.03 ^{hi}
HD Hamadouche	56.73± 1.76 ^{hj}	1.46±0.02 ^{ij}	2.93±0.11 ^{gh}	2.17±0.07 ^{gh}
HD Maghnia	77.23±3.36 ^{k}	1.62±0.03 ^{jk}	4.23±0.18 ^{jk}	3.22±0.14 ^{jk}
Labyadh Id	48.17± 2.72 ^{fh}	1.26±0.03 ^{eg}	2.59±0.17 ^{efg}	1.88±0.13 ^{fh}
Labyadh Tz	40.97± 1.79 ^{efg}	1.23±0.04 ^{ef}	2.17±0.13 ^{cf}	1.69±0.1 ^{dfg}
MahonDemias	19.67±0.67 ^{a}	0.97±0.02 ^{ac}	1.12±0.05 ^{a}	0.72±0.04 ^{ab}
Manga Am	40.8±1.55 ^{efg}	1.12±0.03 ^{de}	1.90±0.08 ^{bcd}	1.38±0.06 ^{cdf}
Manga Baydha	87.8±4.02 ^{k}	1.78±0.04 ^{k}	4.67±0.18 ^{k}	3.34±0.16 ^{k}
Manga Tz	40.27±2.63 ^{efg}	1.14±0.04 ^{def}	2.70±0.19 ^{fh}	1.73±0.12 ^{efg}
Zraa Labled	50.03±3.54 ^{ghi}	1.22±0.03 ^{ef}	2.76± 0.19 ^{fh}	2.08±0.15 ^{gh}

Note: *Significant statistical test p-value= 2e-16*** (2e-16<0.05)

Table 4. Averages and SD adaptative characters of bread wheat accessions of bread wheat in western Algeria

Accession	plant height (cm)*	Spike length without beards (cm)*	length of beards (cm)*	Spike length with beards (cm)*	Stem length (cm)*
Arz A/Fezza	71.72±1.94 bcde	8.06±0.4 eg	6.24±0.14 f	13.56±0.42 jk	63.47±1.95 bcd
Arz FP/Hamadouche	76.58±1.46 cfg	7.54±0.36 cdef	6.47±0.11 f	13.27±0.31 j	63.03±1.17 bcd
ArzRamd Am	93.27±2.02 ln	8.64±0.27 gh	6.51±0.2 f	13.63±0.31 jk	82.73±1.78 hi
Bahamoud	68.02±0.9 b	7.69±0.27 cdg	2.30±0.13 ce	9.59±0.21 fh	58.87±0.82 b
Belmabrouk d3	89.98±1.33 jkln	7.41±0.1 cde	2.53±0.11 de	8.80±0.15 dfg	81.55±1.23 hi
Belmabrouk d5	87.68±1.03 ikl	6.83±0.11 ad	2.31±0.18 ce	8.29±0.15 cde	79.70±1 h
Benmabrouk	81.58±1.18 fi	8.75±0.2 gh	2.20±0.21 ce	10.35±0.24 hi	71.48±1.07 eg
Bent M'barak	67.38±0.96 b	5.84±0.13 a	1.08±0.13 a	6.35±0.21 a	61.35±0.93 bc
El Baydha Ig	58.73±0.96 a	6.96±0.11 bcd	2.44±0.4 de	8.50±0.14 df	50.38±1.22 a
El Hamra	78.12±1.37 efgh	6.65±0.11 ac	2.71±0.14 e	8.62±0.14 df	70.02±1.32 def
El Hamra Ig	52.32±0.7 a	5.77±0.08 a	2.12±0.73 ce	7.02±0.17 ab	45.45±0.67 a
El Hamra Tz	76.97±1.61 dfg	7.20±0.18 bcde	1.56±0.13 ac	7.73±0.17 bcd	69.55±1.54 de
H'bircha	85.43±2.03 hik	7.56±0.15 cdef	0.83±0.07 a	7.80±0.15 bcde	77.22±2.17 fgh
HD FP S/Abdelli	82.37±1.41 gij	9.53±0.13 hi	7.30±0.13 g	16.33±0.26 l	66.77±1.2 ce
HD Hamadouche	95.50±1.64 mn	12.58±0.22 j	6.16±0.19 f	16.82±0.26 l	78.87±1.54 h
HD Maghnia	94.57±1.69 ln	14.72±0.19 k	6.40±0.26 f	18.67±0.24 m	80.07±1.71 h
Labyadh Id	125.10± 2.07 o	8.63±0.19 gh	1.21±0.08 ab	8.96±0.19 efg	116.20±4.03 j
Labyadh Tz	69.07±1.6 bc	6.31±0.14 ab	2.04±0.18 ce	7.64±0.21 bcd	61.68±1.51 bc
MahonDemias	87.93±1.64 iklm	7.73±0.17 dg	7.67±0.2 g	14.67±0.25 k	77.57±1.44 gh
Manga Am	74.22±1.3 bf	6.70±0.13 ad	1.17±0.07 ab	7.14±0.23 ac	67.42±1.27 ce
Manga Baydha	70.15±1.28 bcd	8.64±0.21 gh	2.40±0.13 de	10.01±0.22 gh	60.45±1.22 bc
Manga Tz	92.15± 3.01 kn	10.40 ±0.36 i	2.32±0.12 ce	11.45±0.37 i	81.22±1.21 hi
Zraa Labled	97.10±1.7 n	8.57±0.22 fgh	1.85±0.15 bcd	9.57±0.24 fh	87.68±1.63 i

Note: *Significant statistical test *p-value*= 2e-16; *** (2e-16<0.05)

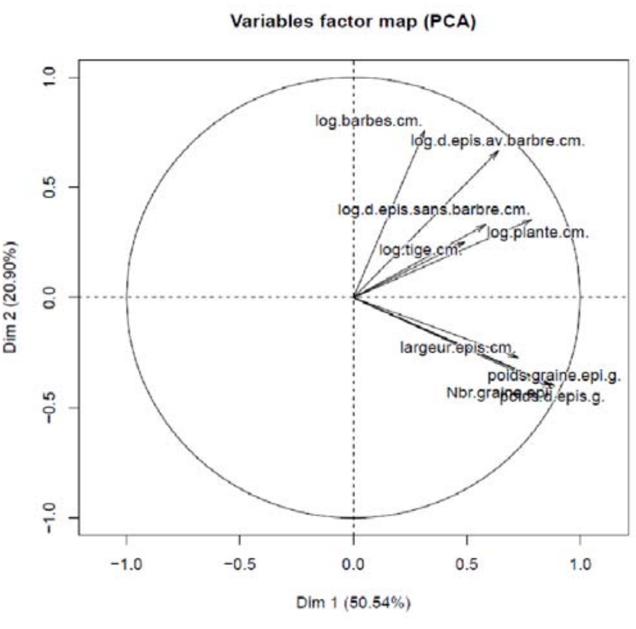

Figure. 2. PCA of bread wheat accessions of Algeria according to the average of different characters for all individuals and regions

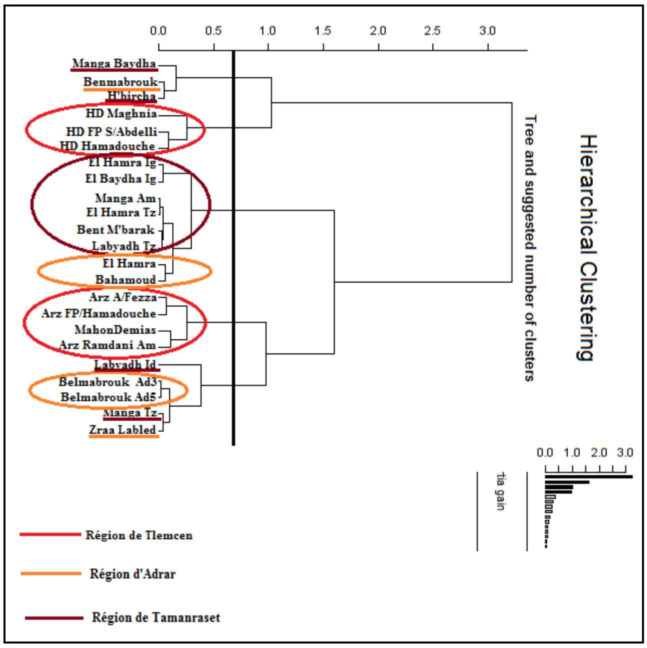

Figure. 3. Hierarchical Ascendante Classification (HAC) of bread wheat in western Algeria

The dendrogram below shows the relationship among the different accessions in this study (Fig. 3). It is divided in to tow major groups. The first divided on 2; namely the bread wheat varieties of Tlemcen region. The second groupe includes the mixture of bread wheat accessions of both Adrar and Tamanrasset. Whereas the other group contains two subdivisions, one is related to bread wheat accessions of Adrar and Tamanrasset. The last subdivision contains a mixture of bread wheat accessions of Tamanrasset and Adrar region.

Discussion

Our study was carried out on 23 accessions spread over an area of 1,004,946 km². This area is equivalent to almost twice the size of France. The number of accessions and study is comparable to the study of Bechar and *al* in 1996 about wheat varieties of Northern Ethiopia spreading over an area of 1.104000 km².

The Shanon and Weaver index H' moyen (0.59) reflects the large morphological diversity spikes of this collection. This diversity is close to that obtained by Al Khanjari et al. (2008) in Omanian original population of Durum and bread wheat with an index of 0.63 for quantitative traits of wheat. For the index H'= 0.19 (El Hamra of Iglene in Tamanrasset) and 0.82 to (Manga of Tazrouk in Tamanrasset), several factors could explain the difference in index values of Shanon and Weaver as localities, including natural factors such as adaptation of local conditions and human factors (Belhadj et al. 2015). The high diversity in the collection is mainly due to the presence of several polymorphic characters with a value (H'> 0.50), particularly, the width of spike (H' = 0.85) which is the highest value of this index. These values are close to those reported by El Khanjari et al. 2008 whit H'= 0.81.

Concerning the length of the plant we have found (H'= 0.59) which is near to the one reported by SAHRI et al. 2014 (H' = 0.53) which was derived from the valley of Er-Rich - Imilchil (Morocco). For spike length without beard (H' = 0.59) a value greater than ours was found by El Khanjari et al. 2008 (H' = 0.74), and Chentoufi et al. 2014 (H' = 0.73). Finally for the number of seeds per spike (H' = 0.58) which are close to the results found by Bechar and *al* 1996 (H' = 0.53) in the Gondar region of Ethiopia. As far as the tow characteristics are concerned: weight of seeds per spike (H '= 0.58), the stem is length and weight of the spike (H' = 0.60) and after consulting several databases we have not found similar work.

The means of H' index, vary from 0.19 for the accessions of El HamraIglen (Tamanrasset) to 0.82 for the Manga accession of Tazrouk region (Tamanrasset). Thirteen accessions with high diversity indices are all traditional names and are located in the three regions studied (Tlemcen, Tamanrasset and Adrar). These results are consistent with those of Chentoufi et al. 2014. The difference of H' calculated for different characters in the three regions (Tlemcen, Adrar et Tamanrasset) is in agreement with the results of Al Khanjari et al. (2008) that showed a differential phenotypic diversity of indigenous populations for bread and durum wheat in Oman based on fifteen qualitative characteristics and seventeen quantitative traits.

Concerning the result of PCA we determine the formation of two groups of characters. This reflects a positive correlation between parameters in each group. The first group includes the length of the plant, the stem length, the spike length with and without beards, and beards length (adaptive traits). The second group contains the width of the spike, the number seeds per spike, the spike weight and the weight of seeds per spike (production traits).

The correlation of these characteristics may be explained by the influence of genes. These traits are controlled by a number of genes, and in general, they react in the same manner according to environmental conditions. To exclude any likelihood, we must have the situation where the same population is changing in the same habitat, to see if the correlations change (and it will be the subject of a future study of our team), otherwise it means that these correlated characters are rather controlled by a number of genes in common.

In summarize, our study, which is aimed to analyze the diversity based on agro-morphological traits of accessions collected in the western Algerian region, has shown that there is significant diversity among different accessions. This work has shown that there is a high diversity due to the presence of high polymorphic characters (plant height, stem length, spike length with beard, spike length without beard, spike width, weight spike, length beards, number of seeds per spike, weight of seeds per spike). This diversity is also due to rise the traditional typological in which these are cultivated accessions characterized by low selective pressure. It would be useful to study the possibility of integrating this material in breeding programs for the development of varieties adapted to environments of Algerian agro-ecological regions (Aggoun 2006). Farmer participation in these programs is to encourage the preservation of the variety which is in danger of extinction. This method is called "conservation through use." It has principle of creating sustainable agricultural systems that is actively used by farmers and determining the possibility of diversity (Tsegay and Berg 2007; Teklu and Hammer 2008). This strategy was developed in Italy by Boggini et al. (1990) and in Tunisia by Daaloul et al. (1990). This study also identified places of conservation in situ. The logical result is that work would block the implementation of these varieties to learn more about their genetic potential and phytotechnology. Finally, a study by molecular markers allow us to have a precise idea about the genetic variability and the exact number of variety, which is very important to be considered for the establishment of the management of significant yet potential plan and breeding.

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