The Libyan Journal of Agriculture
Volume (23), No. (1-2): 2018: 63-76

Original Article

Characterization of some bread wheat (*Triticum aestivum* L.) genotypes by qualitative chemical tests.

Radia Omar Salem[1], Seham Mohamed Alzweek[1], Abraheem Abdullah Abraheem[2] and Heba M. N. Farhat[3]

1- Department of Crop Science, Faculty of Agriculture, University of Tripoli, Tripoli, Libya
2- The National Genebank for Plants Resources (NGPR), Tripoli, Libya
3- The Agricultural and Animal Research Center Tripoli, Libya

Abstract

The diminution of the morphological variation among the new wheat varieties owing to narrow genetic base makes it essential for the development of rapid and reliable methods for genetic purity maintenance during seed production, as well as for plant variety protection, seed certification, quality control and consumer protection. In the present study, attempts were made to distinguish and identify eighteen of wheat genotypes grown in Libya through chemical tests. The seeds were subjected to phenol, two modified phenol, Ninhydrin, NaOH and KOH tests. Based on the colour reaction of different genotypes. Varietal keys were developed for distinguishing the eighteen varieties. All the six chemical tests categorized the varieties from three to seven classes based on their colour reaction. Although, no single chemical test could distinguish all the varieties, but in combination the six chemical tests identified all the eighteen wheat genotypes individually. Therefore, these simple and rapid tests could be employed for varietal identification in most of cereal crops.

Key words: wheat (*T. aestivum*), chemical test, varietal characterization, genetic purity.

Introduction

Bread wheat (*Triticum aestivum* L.) is considered as the first important and strategic cereal crop all over the world, providing 21% of the calories and 20% of the protein to more than 4.5 billion people in 94 developing countries (Braun, *et al.*, 2010). Wheat is the world's second most produced cereal crops (FAO, 2017). According to the recent FAO (2017) reports, European Union, China (Mainland), India, Russian Federation, United States, Canada Ukraine, Pakistan, Turkey, Australia and Argentina are

Corresponding Author: Radia Omar Salem. Crop. Sci. Dep., Faculty of Agriculture, University of Tripoli, Tripoli, Libya.
Phone. +218926282384. Email: radiasalem2007@yahoo.com

Received: 23/4/2018 **Accepted: 12 / 10/ 2018**

among the world's leading producers of wheat in 2017.

Wheat is considered one of the most important grain crops in Libya. As stated by Al-Shreidi and Sbith (2009), wheat provides nearly 40% of caloric intake for the average Libyan, about 1,311 kilo calories (kcal) of the needs of an individual in Libya per day. Given that an individual need 3,330 kcal. Libya is one of the largest wheat importing countries in the world. There is a gap between the production and consumption of wheat in the country (Lariel, 2015). While there are many factors that are contributing to the current gap in wheat production in Libya, the low quality of the seed is one of the important contributing factors to the low productivity of most of the country's agricultural crops, due to the lack of availability of appropriate genotypes for each environment throughout different agricultural production areas (Al-Shreidi and Sbith, 2009, Lariel, 2015). At present, Libya does not have a well-functioning seed system, and therefore, does not have assured access to high quality seed. Additionally, most seeds of improved varieties are imported and not bred for Libyan environment conditions (Lariel, 2015). Improving the genetic quality of the seed is one of the main steps required to increase productivity, which in turn requires improvements in the seed production system and in the availability of the propagation material (Lariel, 2015).

The most important characteristics assuring high quality of the seeds are the maintenance of genetic purity of varieties and avoidance of mechanical admixture occurrence, which is of primary importance for preventing varietal deterioration during successive regeneration cycles, and for confirming varietal performance at an expected level (Mansing, 2010, Mohamed, 2011, Ukani *et al.*, 2016). In the past, the number of commercially cultivated varieties was limited and their identification through visual observations was relatively easy. As the number of varieties increased, phenotypic differences became smaller and the task of identification became gradually difficult (Meziane, 1983).

The variety characterization and identification have attained much importance in almost all major agricultural crops to ensure the quality of seeds marketed to the farmers, meet consumer demands for specified qualities, particularly if the seed is to be used for mechanized processing, as well as, protect new breeder lines and varieties during their multiple breeding stages, and finally, to prevent the indigenous wheat variety and landraces from exposure to the danger of extinction and genetic loss. Thus, it is clearly important from many points of view to be able to distinguish between and identify crop varieties (Meziane, 1983, Mansing, 2010).

The prevalent methods for varietal determination are morphological characterization, biochemical tests and molecular markers (Mansing, 2010). The use of morphological traits in varietal identification and genetic purity testing has many disadvantages such as interaction with environment, time-

The Libyan Journal of AGRICULTURE. Volume (23), No. (1-2) 2018: 63-76

consuming, high cost, expert, labour force and the needs of more area (Mansing, 2010, Vishwanath *et al.*, 2013). To overcome these limitations, various biochemical tests have been developed to reveal chemical differences among the seeds of different genotypes. These chemical tests require no virtually technical skill and can be completed in a fairly short time. The results of these tests are usually distinct, easy to interpret and assist in distinguishing or grouping of cultivars (Masuthi, *et al.*, 2015, Ukani *et al.*, 2016). These tests very often provide supportive evidence for the morphological evaluation of the seeding. Moreover, the new techniques utilized for cultivar identification, enabled seed scientists to expand existing traditional methods. Proteins, isozymes and DNA markers are independent of environmental factors and accurate. However, they are complicated, and difficult, expensive, need more experience and advanced equipments (Mansing, 2010, Vishwanath *et al*, 2013).

Usually, the identification of wheat varieties cultivated in Libya is based primarily on the morphological characteristics of plants. Therefore, the present study was intended to investigate the suitability of chemical tests to determine wheat varieties and obtain the best alternative method to speed up the varietal testing procedure.

Materials and Methods

Seed samples of eighteen bread wheat (*Triticum aestivum*) genotypes were obtained from the National Gene bank for Plants Resources (NGPR), Tripoli, Libya (Table1), and subjected to different chemical tests that include Phenol, modified phenol, Ninhydrin, Potassium hydroxide and Sodium hydroxide. The chemical tests were carried out in the laboratory of genetic, Department of Crop Science, Faculty of Agriculture, University of Tripoli in 2018. Fifty seeds of each genotype were observed visually for seed colour with the aid of magnifying glass.

Standard phenol test:

The standard phenol test for varietal purity testing suggested by (Walls, 1965) was followed. Five replications of 10 seeds each were pre-soaked in distilled water for 24 hours. The seeds were then placed in Petri dishes containing filter paper moistened with 10ml of 4% phenol solution and kept at room temperature. After 4 hours, the seeds were examined for staining and grouped into four categories as; no change in colour, Light brown, Brown and Dark brown.

Modified phenol tests:

Two treatments of the Modified phenol tests were conducted similar to the standard phenol test except that in the first treatment, the seeds were pre-soaked in 0.5% $CuSO_4$ and in the second treatment, the seeds were soaked in 1.5% $FeSO_4$ solution for 24 hours instead of distilled water. Colour reaction was noted after 4 and 24 hours of incubation respectively, and the genotypes were classified based on colouration of seed coat into different categories as; no change in colour, Light brown, Brown, Dark brown, Grey, Light grey, Dark grey and Black (Jaiswal and Agarwal, l995).

Potassium hydroxide (KOH) test:

Five replications of 10 seeds each were soaked in 50 ml of 4% KOH solution and kept at room temperature for three hours and change in colour of the solution and the seeds were observed. Based on the intensity of the colour reaction of the solution, the genotypes were classified into five groups as; no change in colour, Light yellow, yellow, Dark yellow and Reddish brown types. Furthermore, the genotypes were classified based on coloration of seed coat into three groups as; straw yellow, orange and reddish brown (Ukani *et al.*, 2016).

Sodium hydroxide (NaOH) test:

Five replications of 10 seeds each were soaked in 50 ml of 5 percent NaOH solution and kept at room temperature and change in colour of the solution and seeds was observed after one hour. Based on the intensity of the colour reaction of the solution, the genotypes were classified into four groups as; no change in colour, yellow, Dark yellow and Light yellow. Furthermore, the genotypes were classified based on coloration of seed coat into three groups as; straw yellow, orange and reddish brown (Ukani *et al.*, 2016).

Ninhydrin test:

Five replications of 10 seeds each were pre-soaked in distilled water for 24 hours. The seeds were then placed in Petri dishes containing filter paper moistened with 10ml of 0.3 percent Ninhydrin in ethanol and kept in the dark at room temperature for 24 hours. Based on the seed colour development, varieties were grouped as Violet, Light violet, Dark violet and Black (Mohamed, 2011).

Results and discussion

Most of the wheat cultivars grown in Libya are introduced from abroad (Table 1). The majority of these cultivers are introduced to the country in the form of improved varieties or breeder lines or segregated generation of hundreds of wheat hybrids. Thus, they are subjected to countless field evaluation experiments by The Libyan Agricultural and Animal Research Center. The objectives of this evaluation experiments were to select the best genotypes in terms of adapting to the environmental conditions, high yield, resistance to drought and diseases, and their response to fertilization (Al-Shreidi and Sbith, 2009).

Conventionally, the varietal identification has involved visual inspection of morphological characters of plants with the aid of reference manual and systematic descriptors of national set of varieties (Masuthi, *et al.*, 2015). In the current study, an attempt to characterize 18 wheat cultivars was made based on colour reaction to different chemical tests: standard phenol, modified phenol, Ninhydrin, NaOH and KOH test (Figures1,2,3 and 4). Out of eighteen varieties tested 14 were responded positively for standard phenol test (Table 2).

Table1. Description of the wheat genotypes used for varietal characterization

no	Local Name	LBN.*	Situation	Origin	Year of entry	Distribution	Days to ear emergence	Days to maturity
1	Khressi	59	Indigenous	Landrace	1950	Fezzan region	104	150
2	Fritissa	33	Indigenous	Landrace	1950	Fezzan region	108	147
3	Mukthar	46	Bred	Libya	1976	Coastal regions	104	155
4	Sebha	44	Enhanced	CIMMYT	1983	Fezzan region	100	153
5	Mekawe	58	Indigenous	Landrace	1950	Fezzan region	108	152
6	Bohot- 208	470	Enhanced	CIMMYT	2000	All regions	94	150
7	Sidi Misri	29	Enhanced	CIMMYT	1967	All regions	97	150
8	Aboaljoud	1236	Introduced	Italy	2008	All regions	95	165
9	Abolkeir	1237	Introduced	Italy	2008	All regions	100	164
10	Salambo	53	Introduced	Tunisia	2003	All regions	97	155
11	Zelaf	39	Enhanced	CIMMYT	1983	Fezzan region	97	150
12	Germa	66	Enhanced	CIMMYT	1983	Fezzan region	98	152
13	Bushi	1000	Indigenous	Landrace	1950	Fezzan region	100	155
14	Gamine	41	Introduced	Australia	1974	All regions	97	153
15	Hagari	2080	Indigenous	Landrace	1950	Fezzan region	100	150
16	Artin	64	Introduced	France	2005	All regions	107	150
17	Murshosh	24	Introduced	Morocco	1990	All regions	96	150
18	Ashtar	45	Introduced	Morocco	1990	All regions	99	148

* Accession number of inputs in the National Genebank for Plants Resources (NGPR), Tripoli, Libya.

Five showed light brown colour (Fritissa, Sebha, Mekawe, Salambo and Hagari), two developed brown colour (Aboaljoud and Bushi), and six resulted in dark brown colour (Mukthar, Bohot-208, Abolkeir, Zalaf, Germa, Artin and Ashtar). Four of genotypes tested showed no reaction to phenol test (Khressi, Sidi Misri, Gamine and Murshosh) as shown in table 2. The phenol colour test, which is an index of polyphenol oxidase activity, is a simple method for grouping the wheat varieties. During phenol colour test, phenol is oxidized into dark colour melanin catalysed primarily by tyrosinase enzyme, located at seed coat, and is under simple genetic control (Masuthi, *et al.*, 2015; Ukani *et al.*, 2016). This reaction is controlled by single gene (mono-genetically), which is active in seed coat. Therefore, it was considered as important primary descriptor for grouping and identification of wheat varieties (Singh, *et al.*, 2017).

The modified phenol tests with 0.5% $CuSO_4$ (MPT-$CuSO_4$) and with 1.5% $FeSO_4$ (MPT- $FeSO_4$) independently separate all the 18 genotypes into groups similar to the phenol test (Table 2). Among 18 genotypes, the response of three genotypes to the modified test (MPT- $CuSO_4$) was no colour change (Gamine, Hagari and Murshosh), four genotypes were light brown (Fritissa, Sebha, Sidi Misri and Salambo), two genotypes were brown (Mekawe and Bushi), eight genotypes were dark brown in colour (Khressi, Mukthar, Bohot-208, Abolkeir, Zalaf, Germa, Artin and Ashtar), and only one genotype was Black (Aboaljoud) as presented in table 2. Whereas, varieties were classified into seven groups based on the seed colouration with modified test (MPT- $FeSO_4$) as, two no colour change (Fritissa and Hagari), one brown (Mekawe), one dark brown (Khressi), three light grey (Sidi Misri, Salambo and Gamine), three grey (Aboaljoud, Zalaf and Murshosh), two dark grey (Mukthar and Sebha) and six were black in colour (Bohot-208, Abolkeir, Germa, Bushi, Artin and Ashtar) as presented in table 2. The presence of metallic ions Fe^{+2} and Cu^{+2} in modified phenol test enhances the phenol colour reaction since it is based on an enzymatic reaction and these ions act as catalyst (Mansing, 2010, Vishwanath, *et al.*, 2013).

The varieties Gamine (Figure 3) and Murshosh (Figure 4) showed light grey and grey staining for modified test (MPT- $FeSO_4$) but these varieties failed to show the same response for standard phenol test and modified test (MPT- $CuSO_4$). On the other hand, Fritissa (Figure1) displayed light brown colour reaction with phenol test and modified test (MPT- $CuSO_4$), but showed no reaction to the modified test (MPT- $FeSO_4$). Furthermore, Sidi Misri cultivar exhibited no colour reaction with standard phenol test but developed light brown and light grey colour respectively with (MPT- $CuSO_4$) and (MPT- $FeSO_4$) tests (Table 2, Figure 2). Alternatively, Hagari cultivar responded positively to standard phenol test but showed no colour reaction with the modified phenol tests (Table 2, Figure 1). The results are in conformity with findings of a number of workers in rice (Vijayalakshmi and Vijay, 2009, Anitalakshmi *et al.*,

The Libyan Journal of AGRICULTURE. Volume (23), No. (1-2) 2018: 63-76

2014, Masuthi, *et al.*, 2015, Singh, *et al.*, 2017). The phenol test alone may not possess good discriminating power. However, phenol test coupled with modified phenol test could be a viable option to group and identify the varieties, which could be used as simple, cheap and quick method to distinguish the wheat germplasm (Singh, *et al.*, 2017). Sodium hydroxide and potassium hydroxide tests are quite helpful to differentiate red seed varieties from white seed varieties, if the seed coat colour of red seeded varieties disappeared owing to unfavorable climate conditions (Singh, *et al.*, 2017).). Based on the colour reaction to NaOH and KOH the cultivars were grouped into three and four categories respectively (Table 2). All the tested genotypes responded positively to the NaOH test. They turned the soaking solution into a yellow coloured solution. However, the intensity of the colour varied among the varieties.

Table2. Identification and grouping of scented wheat varieties based on chemical tests

No	Genotypes	Phenol test	Modified phenol test		NaOH test		KOH test		Ninhydrin
			CuSO4	FeSO4	solution	seed	solution	seed	
1	Khressi	No colour change	Dark brown	Dark brown	Yellow	Straw yellow	Yellow	Straw yellow	Violet
2	Fritissa	Light brown	Light brown	No colour change	Dark yellow	Orange	Dark yellow	Orange	Violet
3	Mukthar	Dark brown	Dark brown	Dark grey	Light yellow	Orange	Dark yellow	Orange	Light violet
4	Sebha	Light brown	Light brown	Dark grey	Light yellow	Straw yellow	Light yellow	Straw yellow	Violet
5	Mekawe	Light brown	Brown	Brown	Yellow	Orange	Dark yellow	Reddish brown	Violet
6	Bohot- 208	Dark brown	Dark brown	Black	Light yellow	Straw yellow	Reddish brown	Straw yellow	Light violet
7	Sidi Misri	No colour change	Light brown	Light grey	Dark yellow	Straw yellow	Dark yellow	Straw yellow	Violet

8	Aboaljoud	Brown	Black	Grey	Yellow	Straw yellow	Dark yellow	Straw yellow	Light violet
9	Abolkeir	Dark brown	Dark brown	Black	Dark yellow	Reddish brown	Dark yellow	Reddish brown	Dark violet
10	Salambo	Light brown	Light brown	Light grey	Yellow	Straw yellow	Yellow	Straw yellow	Light violet
11	Zelaf	Dark brown	Dark brown	Grey	Light yellow	Straw yellow	Light yellow	Straw yellow	Dark violet
12	Germa	Dark brown	Dark brown	Black	Dark yellow	Straw yellow	Dark yellow	Straw yellow	Dark violet
13	Bushi	Brown	Brown	Black	Light yellow	Straw yellow	Light yellow	Straw yellow	Dark violet
14	Gamine	No colour change	No colour change	Light grey	Light yellow	Straw yellow	Light yellow	Straw yellow	Violet
15	Hagari	Light brown	No colour change	No colour change	Light yellow	Straw yellow	Light yellow	Straw yellow	Dark violet
16	Artin	Dark brown	Dark brown	Black	Light yellow	Straw yellow	Dark yellow	Orange	Light violet
17	Murshosh	No colour change	No colour change	Grey	Dark yellow	Straw yellow	Yellow	Straw yellow	Light violet
18	Ashtar	Dark brown	Dark brown	Black	Light yellow	Orange	Reddish brown	Orange	Violet

Nine genotypes have shown light yellow (Mukthar, Sebha, Bohot- 208, Zelaf, Bushi, Gamine, Hagari, Artin and Ashtar), four genotypes were yellow (Khressi, Mekawe, Aboaljoud and Salambo) and five were dark yellow (Fritissa, Sidi Misri, Abolkeir, Germa and Murshosh) in colour (Table 2). The colour reaction to sodium hydroxide solution obtained in the wheat seeds is due to the reaction of the seeds to secondary metabolites (Mansing, 2010, Ukani *et al*., 2016). Moreover, based on the colour of the seed coat due to the treatment with NaOH solution, the varieties were classified into three groups (Table 2) with thirteen varieties showing straw yellow colour (Khressi, Sebha,

The Libyan Journal of AGRICULTURE. Volume (23), No. (1-2) 2018: 63-76

Bohot- 208, Zelaf, Bushi, Gamine, Hagari, Artin, Aboaljoud, Sidi Misri, Germa, Salambo and Murshosh) and four varieties revealing orange (Fritissa, Mekawe, Mukthar, and Ashtar) in colour reaction (Figures1 and 4), while, cultivar Abolkeir was distinct from other cultivars by displaying reddish brown colour (Figure 3). The difference in colour reaction of seeds to NaOH solution seems to be due to difference in genetic background concerning the enzyme system (Ukani *et al.*, 2016). All red wheat contains pigments, probably in the seed coat, that turn brown when exposed to NaOH. These pigments are absent in white wheat, so the change in colour of white wheat to straw yellow after treatment with NaOH may be due to other compounds, possibly flavones and carotenoids, in the endosperm or seed coat that show through the transparent pericarp (Ram *et al.*, 2002).

In case of potassium hydroxide (KOH), the cultivars of present study showed positive response to this test. Although, all of them displayed yellow colour of soak solution, the intensity of colour was different among the varieties. In addition, the reddish brown colour of the soaked solution category was not found in NaOH test but found in KOH test. Three varieties showed yellow colour (Khressi, Salambo and Murshosh), five varieties revealed light yellow (Sebha, Zalaf, Bushi, Gamine and Hagari), eight varieties resulted in dark yellow (Fritissa, Mukthar, Mekawe, Sidi Misri, Aboaljoud, Abolkeir, Germa and Artin) and two varieties produced reddish brown (Bohot-208 and Ashtar) in colour (Table2). Similarly, All the eighteen varieties were grouped into three distinct classes based on the colour of the seed coat due to the treatment with KOH solution (Table 2). Only two varieties (Mekawe and Abolkeir) developed reddish brown colour (Figures1 and 3). Four have shown orange colour, including: Fritissa, Mukthar, Artin and Ashtar (Figures1,3 and 4) and the rest of the varieties displayed straw yellow colour when treated with KOH solution (Khressi, Sebha, Bohot- 208, Zelaf, Bushi, Gamine, Hagari, Artin, Aboaljoud, Sidi Misri, Germa, Salambo and Murshosh). In the present study, additional three more colour categories could be observed based on the colour of the seed coat due to KOH solution, which was not reported by earlier studies on wheat (Mansing, 2010, Ukani *et al.*, 2016). Anyway, the colour reaction of seed soak solution of both NaOH/ KOH chemicals obtained in wheat may be due to inherent chemical difference or secondary metabolites' reaction present in the seed coat (Mansing, 2010, Ukani *et al.*, 2016).

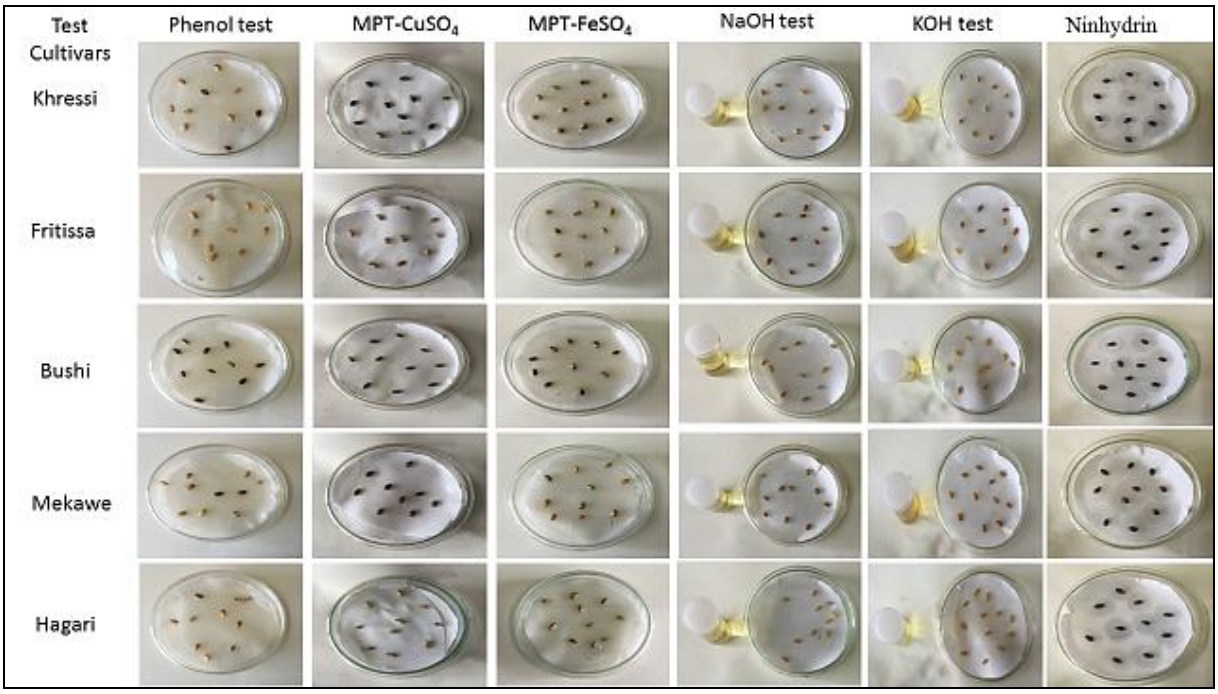

Figure1. Colour reaction of landrace varieties seed to the chemical tests.

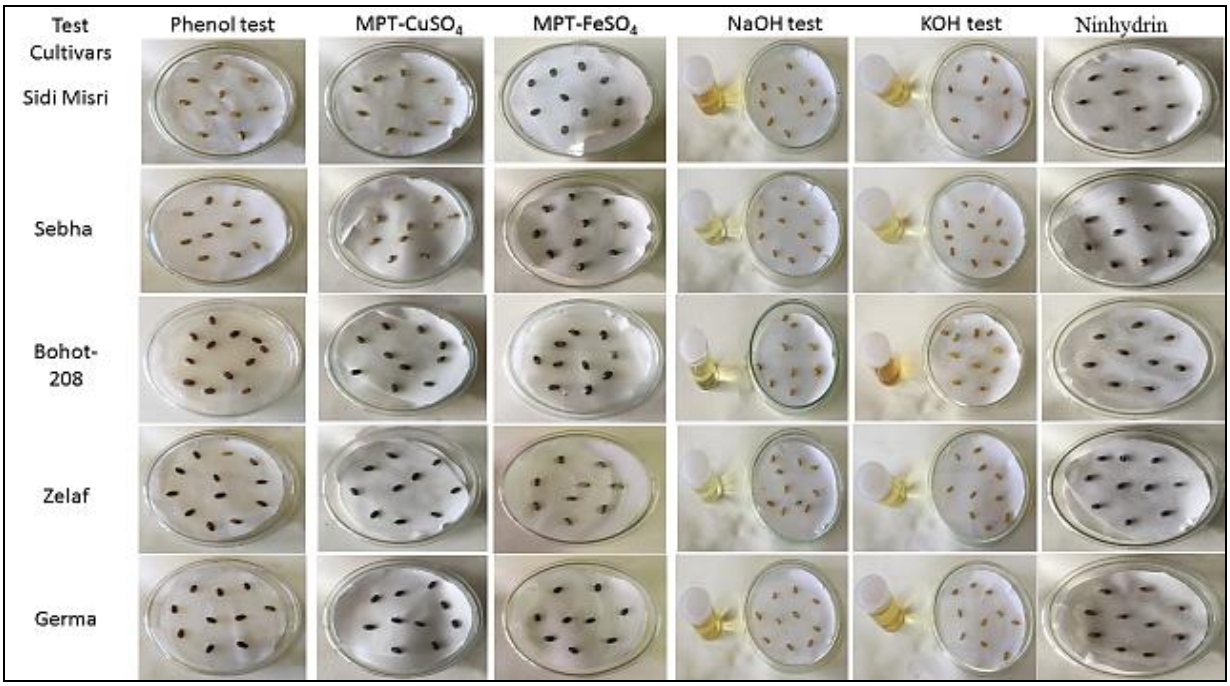

Figure 2. Colour reaction of varieties seed introduced from CIMMYT to the chemical tests.

The Ninhydrin Test is a test for amino acids and proteins with a free -NH_2 group. When such an -NH_2 group reacts with Ninhydrin, a purple-blue complex is formed. Based on the colour reaction with Ninhydrin tests, the genotypes were distinguished into three distinct groups (Table2). Out of 18 genotypes the response of seven genotypes showed violet (Khressi, Fritissa, Sebha,

The Libyan Journal of AGRICULTURE. Volume (23), No. (1-2) 2018: 63-76

Mekawe, Sidi Misri, Gamine and Ashtar), six genotypes were light violet (Mukthar, Bohot-208, Aboaljoud, Salambo, Artin and Murshosh) and five genotypes (Abolkeir, Zelaf, Germa, Bushi and Hagari) exhibited dark violet (Table2, Figures 1, 2, 3 and 4). These results indicated that these varieties contained certain amino acids with a free -NH_2 group could react with Ninhydrin reagent at this concentration, yielding a deep purple colour. Most of amino acids which have free amino groups and Gluten are positive for this test. Similar results were reported by Mohamed (2011). In spite of this, considering the results obtained with Ninhydrin reagent, it is advisable to develop more accurate methods of varietal identification, that deal specifically with individual amino acid reaction.

The seed components vary between the cultivars and the reaction of these components with chemical tests resulted in different colour alteration. The phenol test separated the eighteen varieties into four distinct groups. Two genotypes, Abolkeir and Germa exhibited a dark colour in phenol reaction. This dark colour was a characteristic of these varieties since they were uniform for the other tests (Table2, Figures 2 and 3). Additionally, four genotypes, Bohot- 208, Mukthar, Artin and Ashtar showed dark colour reaction with the phenol, modified phenol and KOH tests. Yet, they displayed light colour with both the NaOH and Ninhydydrin tests (Table2, Figures 2, 3 and 4). On the other hand, Salambo cultivar was distinct from other cultivars by displaying light colour with all chemical tests (Table 2, Figure 4). It has been observed that out of all the cultivars tested with the NaOH/ KOH solutions, only four genotypes showed orange colour (Fritissa, Mukthar, Artin and Ashtar) and two genotypes (Mekawe and Abolkeir) developed reddish brown colour (Figures 1, 3 and 4), which appeared to be genetically red wheat. The intensity of colour varied among them due to different concentrations of pigments in the seed coat. More importantly, it has been noted that a single chemical test may not be adequate to distinguish the wheat accessions and several tests are required to be utilised in a complementary manner. Additionally, varietal identification keys were developed for identification of each and every cultivar based on distinguishable chemical characteristics, and all the cultivars were differentiated based on these identification keys. Among the chemical tests used in this study, the standard phenol and modified phenol tests provided stable results. In view of high heritability and stability of phenol colour reaction, it could be operated as primary diagnostic character for distinguishing the wheat genotypes. Potassium hydroxide and Sodium hydroxide also could be employed to identify the red seeded varieties. In addition, the Ninhydrin test could be applied to detect the leakage of amino acids and assessing individual seed purity and quality. Hence, these chemical tests could be used as simple, quick and cheap laboratory methods for determining the varietal purity of wheat genotypes.

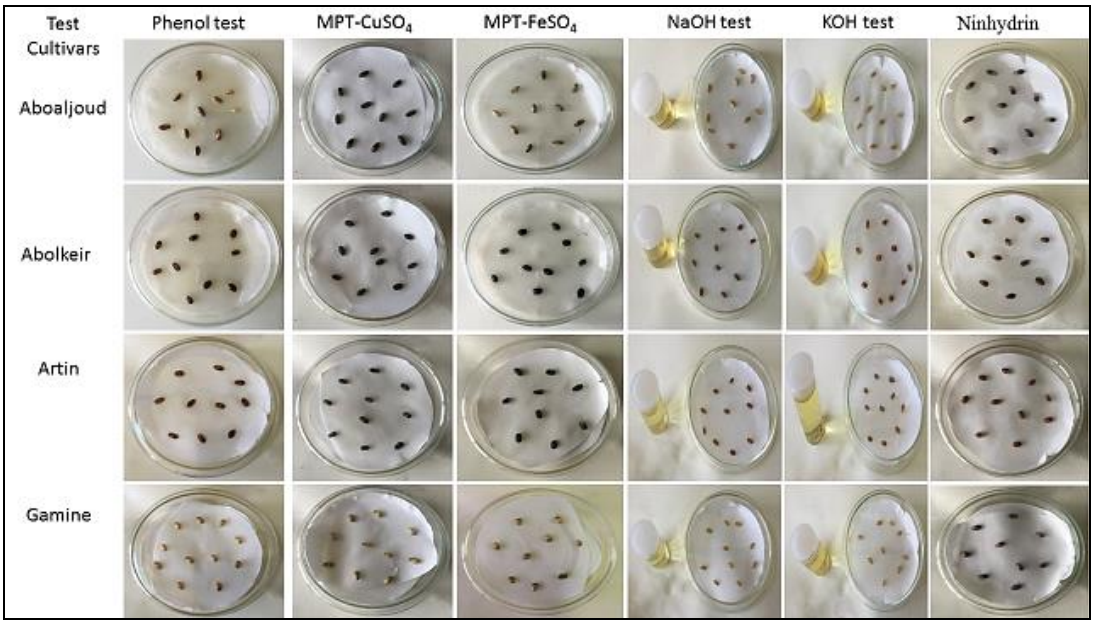

Figure 3. Colour reaction of varieties seed Introduced from EU and Australia to the chemical tests.

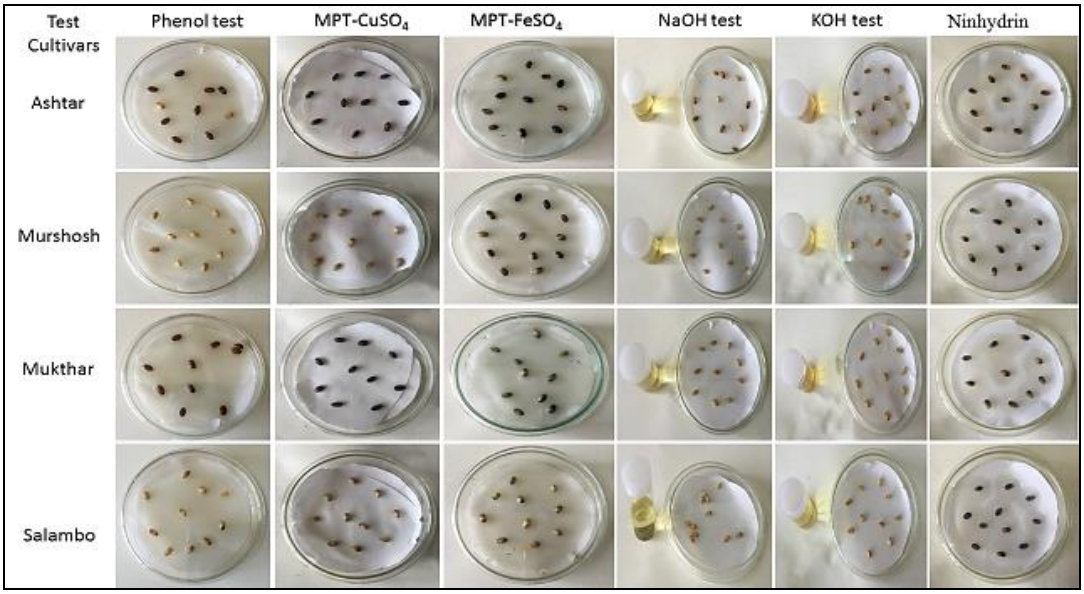

Figure4. Colour reaction of North Africa varieties seed to the chemical tests.

References

Al-Shreidi, A. and Sbith, A. 2009. References study on the status and development seed system in Libya (in Arabic). The Agriculture and Animals Research Center and ICARDA (Unpublished). Tripoli, Libya.

Anitalakshmi, V., Gowda, R., Sathisha, C. and Prasad, R. 2014. Varietal response to various chemical tests for their characterization in Rice (*Oryza sativa* L.). Indian Journal of Plant Sciences, 3(2), 177-179.

The Libyan Journal of AGRICULTURE. Volume (23), No. (1-2) 2018: 63-76

Braun, H., Atlin, G. and Payne, T. 2010. Multi-location testing as a tool to identify plant response to global climate change. In M. P. Reynolds (Ed.), Climate change and crop production (pp. 115-138). CABI, London, UK.

FAO. 2017. Food Outlook: Biannual report on global food markets. FAO Trade and Markets Division.

Jaiswal, J. P. and Agrawal, R. L.1995. Varietal purity determination in rice: modification of the phenol test. Seed Sci. and Technol., 23: 33-42.

Lariel, N. 2015. Challenges in the sustainability of Libyan agriculture: Opportunities for the Libyan seed system. Doctoral Dissertation, Colorado State University, Fort Collins, Colorado, USA.

Mansing, J. S. 2010. Characterization of wheat (*Triticum* spp.) genotypes through morphological chemical and molecular markers. Master thesis, University of Agriculture Sciences, College of Agriculture, Seed Science and Technology, Dharwad. India.

Masuthi, D., Vyakarnahal, B. S., Deshpande, V. K., Jagadeesha, R., Chavan, M. L. and Khaja, R. S. 2015. Characterization of traditional aromatic Rice cultivars by chemical markers. International Journal of Advanced Research, 3(5), 103-107.

Meziane, A. A. 1983. Laboratory methods for wheat variety identification. Master thesis, Oregon State University, Crop Science, Oregon, USA.

Mohamed, E. A. 2011. Laboratory Methods for The Recognition of Seeds of Some Wheat (*Triticum aestivum* L.) Varieties. J. Plant Production, Mansoura Univ., 2(1), 157-163.

Ram, M. S., Dowell, F. E., Seitz, L. and Lookhart, G. 2002. Development of Standard Procedures for a Simple, Rapid Test to Determine Wheat Colour Class. Cereal Chemistry, 79(2), 230–237.

Singh, C., Kumar, S. J., Sripathy, K., Somasundaram, G., Bhaskar, K. U., Ramesh, K., Kumar M. and Prasad, S. R. 2017. Characterization and Identification of Rice Germplasm Accessions Using Chemical Tests. Seed Research, 45(1), 75-83.

Ukani, J. D., Patel, J. B., Babariya, C. A. and Ramani, P. S. 2016. Characterization of wheat varieties (*Triticum* Spp.). The Bioscan, 11(1), 315-319.

Vijayalakshmi, B. and Vijay, D. 2009. Development of Seed Keys for Varietal Identification in Rice (*Oryza sativa*) using Chemical Tests. Seed Research, 37(2), 65-61.

Vishwanath, K., Pallavi, H., Nethra, N. and Prasad, S. R. 2013. Chemical tests for identification and characterization of tomato cultivars. Plant Breeding and Seed Science, 68, 3-13.

Walls, W. 1965. A standardized phenol method for testing wheat seed for varietal purity. AOSA contribution number 28.

توصيف بعض التراكيب الوراثية للقمح الطري (*Triticum aestivum* L.) باستخدام الاختبارات الكيميائية

راضية عمر سالم[1]، سهام محمد الزويك[1]، إبراهيم عبد الله إبراهيم[2] و هبه محمد فرحات[3]

1- قسم المحاصيل- كلية الزراعة – جامعة طرابلس - ليبيا

2- البنك الوراثي الوطني للموارد النباتية – طرابلس- ليبيا

3- مركز البحوث الزراعية والحيوانية – طرابلس - ليبيا

المستخلص

إن تضاؤل التباين الظاهري بين أصناف القمح الجديدة بسبب ضيق القاعدة الوراثية جعل من الضروري تطوير طرق سريعة وموثوقة للمحافظة على النقاوة الوراثية أثناء إنتاج البذور، وكذلك لحماية الأصناف النباتية وشهادات البذور، ومراقبة الجودة وحماية المستهلك. تم في هذه الدراسة استخدام الاختبارات الكيميائية للتمييز والتعرف على ثمانية عشر من التراكيب الوراثية للقمح المزروعة في ليبيا. عوملت البذور بعدة مواد كيمائية منها (الفينول المعياري، اثنان من اختبارات الفينول المعدل، هيدروكسيد الصوديوم، هيدروكسيد البوتاسيوم والنهادرين). وبناء على التغيير في لون البذور، تم تطوير مفاتيح متنوعة لتمييز هذه الأصناف. قسمت جميع الاختبارات الكيميائية والأصناف المدروسة من ثلاث إلى سبع فئات بناء على تدرجهم اللوني. وعلى الرغم من ذلك، فقد تبين أن اختبار كيميائي واحد لا يكفي لتمييز الأصناف المختلفة، إلا إنه بالإمكان استخدام الاختبارات الكيميائية الستة لتصنيف جميع التراكيب الوراثية بشكل فردي. وعليه يمكن استخدام هذه الاختبارات البسيطة والسريعة لتحديد الأصناف في معظم محاصيل الحبوب، فهي لا تتطلب عمليا أي خبرة فنية أو تدريب ويمكن أن تكتمل في وقت قصير نسبيا.

كلمات دالة : القمح (*T. aestivum*)، اختبار كيميائي، توصيف الأصناف، النقاوة الوراثية..

للاتصال: راضية عمر سالم. قسم المحاصيل - كلية الزراعة - جامعة طرابلس - ليبيا.

هاتف: 218926282384+. البريد الالكتروني: radiasalem2007@yahoo.com

استلمت بتاريخ: 2018/4/23 **أجيزت بتاريخ: 12/ 2018/10**