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Description & Evaluation of Twelve Wine Grape Cultivars in Jabal Alkhdar Area – Libya

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ABSTRACT

This investigation was conducted for two successive seasons (2014 & 2015) for description and evaluation of twelve wine grape cultivars namely. Alicante Bouchet, Cabemet Sauvignon, Carignan, Cinsaut, Clairatte, Grenache, Merlot, Muscat Petitgrain, Pinot Blanc, Sauvignon Blanc, Sylvaner, & Syrah. The chosen vines grown in a heavy clay, under rain fed conditons in Messa region, Elbida- Libya Some phenological aspects, description studies including (growing tips, leaves, tendrils, bunches and berries), and chemical studies of bunches and berries were carried out. Maturity of grape cultivars can be divided into 3 groups: (1) Very early Mature Cultivars (27/6 to 10/7): Syrah, Alicante Bouchet. (2) Early Mature Cultivars (12/7 to 28/7): Cinsaut, Clsiratte, Merlot, Sylvaner, Muscat Petit Grain, Carignan (3) Medium Mature Cultivars (2/8 to 7/8): Piont Blanc, Cabernet Sauvignon, Grenache, Sauvignon Blanc. All studied cultivars were characterized by good vegetative growth and bunch quality. All studied cuitivars had small size bunch except Cinsaut, Grenache, & Sauvignon Blanc had medium size bunch and Sylvaner cultivar had very small size bunch. Data showed that the grape cultivars characterized by small bunches, where bunch weight ranged from 114g (Sylvaner) to 252g (Cinsaut). Concerning berry weight and size, Cabernet Sauvignon, Cinsaut, Grenache, Merlot, Sylvaner& Syrah cultivars characterized by very snall berry size, whereas Alicante Bouchet, Carignan, Muscat Petitgrain, Pinot Blanc & Sauvignon Blanc cultivars had small berry size and Clairette cultivar characterized by medium berry size. As for the berry shape, all cultivars had spherical shape except Clairette cultivar had oval shape. Concerning berry color, it is clear that in all cultivars it was red except Alicante Bouchet, Cabernet Sauvignon, Carignan, Cinsaut& Syrah had black berry color. The average weight of 100 berries of these cultivars ranged from 90g (Carbernet sauvignon) to 267g (Cinsaut). All cultivars showed TDS values suitable for the production of quality wine. The total sugars of these wine grape cultivars ranged from 14.6% (Clairatte) to 19.0% (Merlot, Sauvignon Blans), with an average value (17.83 ± 1.31). In general, the results showed that these different grapevine cultivars offer satisfactory and typical phenological characteristics during growth and at maturity, in relation to classical table cultivars growing regions of the world, showing a good adaptation to the cultivation, Massa Elbeda,Libya.

Keywords: *Wine Grape cultivars, morphology & phenology, Jabal Alkhdar*

Abbreviation: *S = small, VS = very small, M = medium, L = large. CO = conical, LCO = long conical, COS = conical with shoulders. 2 = loose. 4 = compact, 3 = medium compact. SP = spherical, O = oval, - B = black, BB = Blue-black, BR = brown, GR = grey, R= red, DR = dark red, Y = yellow, LY = light yellow, GY = green yellow. RG = reddish green, G = green, W = white, MTK = medium thick, TK = thin. SH = short, VSH = very short, M = medium. F = fleshy, J= Juicy, Cr = crispy. P = present, A = absent. P = pentagonal, C = circular, Br = bristle, Co = cottony, S = spidery, D = deep, HD = half deep, SH = shallow, O = open, WO = wide open, DO = deep open, CL = closed, SM = smooth, R = rough, BL = blister.*

INTRODUCTION

Grape is considered as one of the most important fruit crops in the world. In Libya, grape occupies the fourth rank after citrus, olives & dates. The total grape production in Libya during 2009 was 130000 tons according to the latest statistics of Ministry of Agriculture (2009). In 1981 Ministry of Agriculture through the Agriculture Development system introduced some newtable & wine grape cultivars which have been planted in different growing regions in Libya; these cultivars were found to have different morphological characteristics and bunch quality. Cultivars can be characterized by several methods: (1) Moprhological description of parts of the plants (shoots, leaves, berries, etc.) at different phenological stages (Olv, 1984). (2) Morphometry based on the measurement of parameters of plant organs and phenological dates, i.e. dates of budburst and harvesting (Galet, 1952 & Cabello et al. 1993). (3) Analysis of biochemical

compounds either quantitatively or quantitatively. These examinations of some grapevine parameters remain the most important and easiest means for the identificationof qualities (Fraga et al. 2016).Each grape species has a uniquely preferred environment for ideal growing. Because climates vary from country, selecting the best strain is an important in grape cultivation. In addition, because climatic factors such as temperature and rain canbeunpredictableanduncontrollable,eachyearwillproduceuniquequalitiesandyieldsofgrapes.Previous trials dealt with the description and evaluation of grape = cultivars (Olmo, 1946; Kamel,1964; Winkleretal.,1965;BrooksandOlmo1972;Bachaetal.1982;Deeretal.1982;Watt,1983; Winker and Boursiquote, , 1992; Abd El-Kawi and El-Yam, 1992 a, b and c; Abd El-Fatah and Kastor, 1993 a and b; Morrison, 1994; Tourky et al., 1995; El Sharkawy 1995; Fawzy 1998; Aisha et al., 1998; Marwad, 2002 a and b; Gaser, 2006; Girgis 2007; Al-Yami 2008; Sabry et al., 2009; and Abd EL-Wahab, 2011). The goal of this study was to describe and evaluate twelve wine grape cultivars, ten of them imported from France & two from Spain Cultivated under Libyan conditions, in Messa region, Elbida, Aljabal Alkhdar, with special stress on some characteristics which may serve in distinguishing these cultivars.

Materials & Methods

The studied area is located in the northeastern part of Libya, bounded from the north, Mediterranean Sea and latitude 33° S, and Elbeda city from east and latitude 25° and Suluq City from west and longitude 15° 20. The length of this area estimated by 650 km the study area (Massa) is considered as the center of Jabal Alkhdar area, where it is located 20 km from Mediterranean Sea and at altitude of 490 meters above sea level. The rainy season starts in November and ends in May. The rate of annual rainfall in this area is about 500 mm, and this varies from year to year. Massa area enjoys a Mediterranean climate, which is characterized by a cold rainy winter, and relatively hot dry summer and temperate spring and autumn. The average annual temperature is about (18°C), where September is the warmest month of the year with an average temperature around the (26°C), while January is the coldest month of the year, where the average temperature is reduced to 10°C. The rate of relative humidity in this area is about (60%), it reaches (75%) in January and (51%) in June. The texture of soil is heavy clay and characterized by reddish-brown color. Thep Hisslightly alkaline ranging from 7.5- 8. Organic matter % is about 2% and the cation exchange capacity of this soil is high. Sometimes hardpan patches at 35 cm depth from soil surface are found. Description of grapevines under study was done according to the descriptors of grapevine issued by The International Plant Genetic Resources Institute (IPGRI) which is an autonomous international scientific organization operating under the aegis of the Consultative Group on International Agricultural Research (CGIAR). And Prof. GALET method, College of Agriculture (Montpellier) France and characterization of G. TAMPOM -P. MANZO (Rome) Italy (1987).

The studied parameters were as follow: (a) Phenophysiological characters, (b) Leaf characterization, (c) Bunch characterization, (d) Berry characterization, (e) Fruit chemical characteristics.

Table1. *Wine grape cultivars under study*

No	Cultivar name	Source
1	Alicante Bouchet	France
2	Cabernet Sauvignon	France
3	Carignan	Spain
4	Cinsaut	France
5	Clairatte	France
6	Grenache	Spain
7	Merlot	France
8	Musscat Petitgrain	France
9	Pinot Blanc	France
10	Sauvignon Blanc	France
11	Sylvaner	France
12	Syrah	France

Results

Descriptive Measurements

Data concerning the evaluation and the morphological description of the studied cultivars are presented in Table (2 a & b).

New Vegetative Growth

Growing tip color: Carignan, Cinsaut, Grenache, Merlot, Pinot Blanc, Sauvignon Blanc, & Syrah cultivars had green color, while Clairatte, Muscat Petitgrain, & Sylvaner cultivars had light green color and Alicante Bouchet& Cabernet Sauvignon had reddish greencolor.

Twig Color

All cultivars had green color.

New Leaf Color

All cultivars had green color.

New Leaf Hairs

Alicante Bouchet & Sylvaner cultivars had cottony hairs, whereas Cabernet Sauvignon,

Carignan, Cinsaut, Clairatte, Syrah, Merlot & Sauvignon Blanc cultivars had spidery hairs. Muscat Petitgrain & Pinot Blanc cultivars had bristle hairs and Grenache cultivar had nohairs.

Table(2a). *New vegetative growth characteristics*

Cultivars	Growing tip color	New leaf		Twigs color
		color	Hairs	
1	RG	G	Co	G
2	RG	G	S	G
3	G	G	S	G
4	G	G	S	G
5	LG	G	S	G
6	G	G	A	G
7	G	G	S	G
8	LG	G	Br	G
9	G	G	Br	G
10	G	G	S	G
11	LG	G	Co	G
12	G	G	S	G

Mature Leaf

Leaf Shape

The following cultivars: Alicante Bouchet, Cinsaut, Grenache, Muscat Petitgrain, & Sylvaner had pentagonal leaf shape, Whereas Cabemet Sauvignon, Carignan, Clairatte, Merlot, Pinot Blanc, Sauvignon Blanc, & Syrah cultivars had circular leafshape.

Leaf size

All cultivars had a large leaf size except Carignan & Muscat Petitgrain cultivars which had medium sizeleaf.

Leaf Hairs

The cultivars Alicante Bouchet&Sylvaner had cottony hairs, whereas Cabemet Sauvignon, Clairatte, Syrah, Merlot, & Pinot Blanc cultivars had spidery hairs & Cinsaut, Muscat Petitgrain & Sauvignon Blanc cultivars had bristle hairs. Grenache & Carignan cultivars had no leaf hairs.

Leaf Lobes

Number of leaf lobes in all cultivars under studied wasfive.

Lobes Depth

With regard to depth of lobes, it was noticed that all cultivars were half deep except Alicante Bouchet cultivar had shallow lobes and Cabemet Sauvignon cultivar had deep lobes.

Leaf Texture

All cultivars showed rough leaf surface, except Carignan & Grenache had Smooth leaf surface.

Petiole Length

All cultivars had short petiole except Alicante Bouchet, Grenache, Merlot, & Muscat Petitgrain cultivars had very shortpetiole.

Petiole Sinus

It was found that Cabemet Sauvignon, Syrah, Pinot Blanc & Sauvignon Blanc cultivars had closed sinus while Alicante Bouchet& Grenache had open sinus. Carignan & Merlot cultivars had narrow open sinus, whereas Cinsaut, Muscat Petitgrain &Sylvaner cultivars had wide open sinus. Clairatte cultivar had overlapsinus.

Bunch Characteristics

Bunch Shape

It was noticed that the following cultivars: Cabemet Sauvignon, Clairatte, Grenache, Muscat Petitgrain, Pinot Blanc, & Sauvignon Blanc had conical shape bunch while Merlot cultivar had long conical bunch and Alicante Bouchet, Cinsaut, &Sylvaner cultivars had conical bunch with shoulders. Carignan & Syrah cultivars had cylindricalbunch.

Bunch Size

All cultivars had small bunch except Cinsaut, Grenache, & Sauvignon Blanc had medium bunch and Sylvaner cultivar had very smallbunch.

Bunch compactness

All cultivars had compact (4) bunch, except Carignan cultivar had very compact (5) bunch and Muscat Petitgrain had medium compact (3) bunch.

Table(2b). *Mature Leaf characterization*

Cultivars	Leaf				Lobes		Petiole	
	Shape	Size	hairs	texture	Number	Depth	sinus	Length
1	P	L	Co	R	5	SH	O	VSH
2	C	L	S	R	5	D	Cl	SH
3	C	M	A	SM	5	HD	NO	SH
4	P	L	Br	R	5	HD	WO	SH
5	C	L	S	R	5	HD	OV	SH
6	P	L	A	SM	5	HD	O	VSH
7	C	L	S	R	5	HD	NO	VSH
8	P	M	Br	R	5	HD	WO	VSH

9	C	L	S	R	5	HD	Cl	SH
10	C	L	Br	R	5	HD	Cl	SH
11	P	L	Co	R	5	HD	WO	SH
12	C	L	S	R	5	HD	Cl	SH

Bunch Length

Concerning wine cultivars, Sylvaner has short bunch (11-16 em), while Alicante Bouchet, Cabemet Sauvignon, Carignan, Clairatte, Merlot, Sauvignon Blanc, Syrah cultivars had long bunch (21-26em), and Cinsaut, Grenache, Muscat Petitgrain, Pinot Blanc, & Sylvanerhad intermediate long bunch (16-21 cm). Total bunch length (Bunch length + Peduncle length) for the studied cultivars ranged from 14 cm (Sylvaner) to 24 cm (Alicante Bouchet& Sauvignon Blanc).

Bunch Width

Bunch width of wine grape cultivars ranged from 7 cm (Sylvaner) to 11 cm (Cinsaut, Grenache).

Peduncle Length

With regard to peduncle length, it was ranged from 2 cm (Cabemet Sauvignon, Cinsaut, Grenache, Pinot Blanc, Sylvaner) to 6 cm (Sauvignon Blanc).

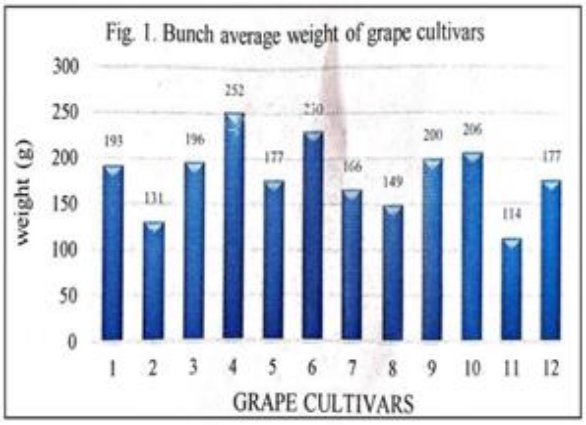
Bunch Weight

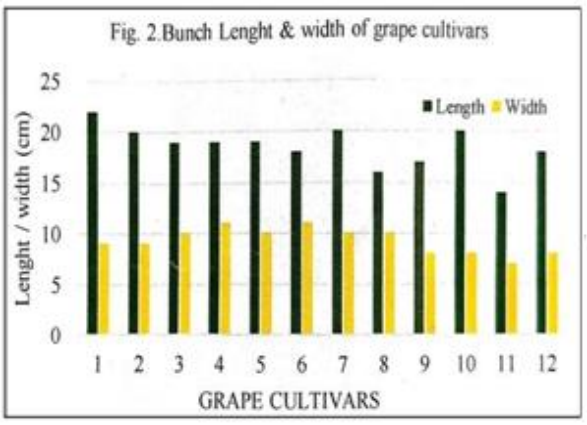
Data showed that the grape cultivars characterized by small bunches, where bunch weight ranged from 114 g (Sylvaner) and 252 g (Cinsaut). (Table 3, Fig. 1 &2).

The result in this respect is agreed with many investigators worked on different cultivars (Aisha et aI., 1998; Marwad 2002 a & b).

Table3. *Bunch characterization of grape cultivars*

Cultivars	size	Shape	Weight (g)	Length (cm)	Width (cm)	Bunchtotal Length(cm)	Bunch compactness
1	S	COSH	193	22	9	4	24
2	S	CO	131	20	9	2	22
3	S	CY	196	19	10	3	22
4	M	COSH	252	19	11	2	20
5	S	CO	177	19	10	3	22
6	M	CO	230	18	11	2	19
7	S	LCO	166	20	10	4	22
8	S	CO	149	16	10	3	17
9	S	CO	200	17	8	2	18
10	M	CO	206	20	8	6	24
11	vs	COSH	114	14	7	2	14
12	S	CY	177	18	8	5	22
Mean ± SD			**182.58 ±39.35**	**18.5 ± 2.11**	**9.25 ± 1.29**	**3.17 ±1.34**	**20.5 ± 3.0**





Berry Characteristics

Berry Shape

Alicante Bouchet, Cabemet Sauvignon, Carignan, Cinsaut, Grenache, Merlot, Muscat Petitgrain, Pinot Blanc, Sauvignon Blanc, Sylvaner& Syrah cultivars had spherical shape, whereas Clairette cultivar had ovalshape.

Berry Size

Cabemet Sauvignon, Cinsaut, Grenache, Merlot, Sylvaner& Syrah cultivars characterized by very

small berry size, Alicante Bouchet, Carignan, Muscat Petitgrain, Pinot Blanc & Sauvignon Blanc cultivars had small berry size and Clairette cultivar characterized by medium berry size.

Berry Color

Clairattre, Muscat Petitgrain, Sylvaner, Pinot Blanc & Sauvignon blanc had yellow color; Grenache &Ribol cultivars had red berry color and Alicante Bouchet, Cabernet Sauvignon, Carignan, Cinsaut& Syrah had black berrycolor.

Berry Thickness

Concerning berry thickness, it is clear that in Cabernet Sauvignon, Carignan, Cinsaut, Grenache, Merlot, Muscat Petitgrain & Pinot Blanc cultivars it was thin, thick in Alicante Bouchet, Clairette, Sauvignon Blanc, Sylvaner, & Syrahcultivars.

Berry Pedicel

With regard to berry thickness, it is clear that in Alicante Bouchet, Cabernet Sauvignon, Cinsaut, Merlot, Muscat Petitgrain, Pinot Blanc, Sauvignon Blanc, Sylvaner& Syrah cultivars it was very short, short in Clairette, Carignan & Grenache cultivars.

Flesh Color

Clairette, Grenache, Merlot, Muscat Petitgrain, Pinot blanc &Sylvaner cultivars had white flesh color, whereas Carbernet sauvignon, Carignan, Cinsaut, Sauvignon blanc & Syrah cultivars had green flesh color and Alicante Bouche cultivar had red fleshcolor,

Flesh Texture

All cultivars showed juicytexture.

Presence of Seeds

All berries of cultivars contain 2 seeds except Grenache, Merlot &Sylvaner cultivars contain 3seeds.

Berry Length

Ranged from 12 mm (Clairette, Sylvaner, Syrah) to 19 mm (Cinsaut).

Berry Diameter

Ranged from 11 mm (Syrah) to 16 mm (Cinsaut).

Berry Weight

Average berry weight was 1 g in Cabernet Sauvignon, Cinsaut, Merlot, Sylvaner& Syrah cultivars, therefore these cultivars can be considered small berries, while average berry weight was 2 g in Carignan, Grenache, Muscat Petitgrain Pinot Blanc & Sauvignon Blanc cultivars. Average berry weight of Clairatte cultivar was 3 g. The average weight of 100 berries of these cultivars ranged from 90 g (Carbernet sauvignon) to 267 g (Cinsaut). The results in this respect are in line with those of many investigators working on different cultivars (Ismail, 1989, Tourky et aI., 1995; Fawzy, 1998; Aisha et at, 1998 and Marawad 2002 a &b)

Table4. *Berry characterization of grape cultivars*

Cultivars	Berry					Flesh		Seeds		
	Shape	Size	color	Thickness	Pedicel	Color	Texture	Presence	Number	Color
1	SP	S	B	TK	VSH	R	J	P	2	BR
2	SP	VS	B	TH	VSH	G	J	P	2	BR
3	SP	S	B	TH	SH	G	J	P	2	BR
4	SP	VS	YW	TH	VSH	W	J	P	2	BR
5	O	N	B	TK	SH	G	J	P	2	BR
6	SP	VS	DR	TH	SH	W	J	P	3	BR
7	SP	VS	B	TH	VSH	W	J	P	3	BR
8	SP	S	Y	TH	VSH	W	J	P	2	BR
9	SP	S	G	TH	VSH	W	J	P	2	BR
10	SP	S	GW	TK	VSH	G	J	P	2	BR
11	SP	VS	GW	TH	VSH	W	J	P	3	BR
12	SP	VS	B	TK	VSH	G	J	P	2	BR

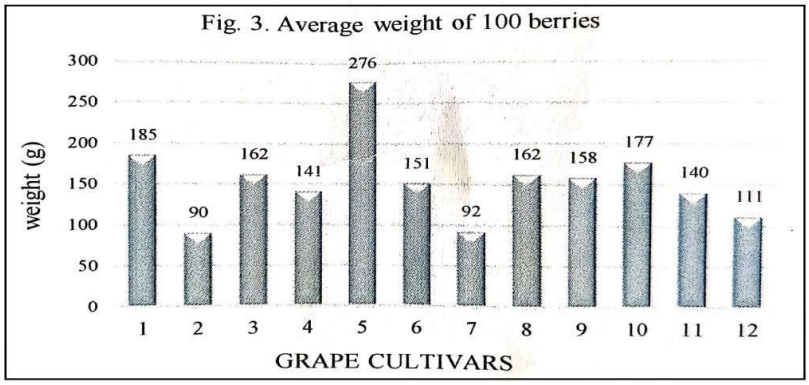
Berry Chemical Parameters

Table 6, showed the mean values of Dry matter (%), Total Dissolved Solids (TDS) (%), Total Titratable Acidity (TA) (%), and sugars (%). Dry matter % ranged from 18.8% (Clairatte) to 21.7% (Syrah), with an average value (20.31 ± 0.94), whereas TDS% ranged from 16.8% (Clairatte) to 19.6% (Cabernet Sauvignon), with an average value (18.45 ± 1.04). All cultivars showed TDS values suitable for the production of quality wine.

The most important acid in grapes is tartaric acid. The concentration of this acid in unripe grapes is 15g/L in cooler climates when Compared with around 2g/L in ripe grapes in warm regions. Malic acid concentrations in unripe white cultivars can reach 25glL. At maturity, this number can drop to 19/L in warmer regions. Citric acid concentrations in must range around0.5glL.

Table5. *Berry's Length, diameter & weight*

Cultivars	Length(mm)	Diameter (mm)	Weight (g)	Av. Wt. of 100 berries (g)
1	15	15	1.5	185
2	13	13	1	90
3	15	14	2	162
4	12	12	1	141
5	19	16	3	276
6	14	14	2	151
7	13	13	1	92
8	13	14	2	162
9	14	13	2	158
10	15	13	2	177
11	12	12	1	140
12	12	11	1	111
Mean ± SD	**13.92 ± 1.97**	**13.33 ± 1.37**	**1.63 ± 0.64**	**153.75 ± 49.24**



Percent acidity for the wine cultivars under study ranged from 0.25% (Cinsaut) to 0.57% (Syrah), with an average value (0.396 ± 0.099). When wine grapes are still green, they have very high acidity. As they ripen, the acidity tapers down and the sweetness increases. The perfect moment, of course, is when the grape is perfectly sweet, ripe, and still possessing enough acidity to make great wine. This is where climate comes in. A region that produces wines with naturally higher acidity will have either cooler nighttime temperatures or a shorter growing season. The cool nights and cold weather stop the grapes from losing their acidity. In a region with a shorter growing season, there's also the possibility that the grapes never quite get ripe enough, which results in both moretart and more herbaceous tasting wines.

The results are in harmony with those of many investigators working on different cultivars (El Sharkawy 1995; Fawzy 1998; Aisha et ai., 1998; Marwad, 2002 a & b; Gaser, 2006; Girgis 2007 and Sabry et aI., 2009). Glucose, along with fructose, is one of the primary sugars found in wine grapes, while sucrose is not a natural constituent of grapes. The total sugars of these wine grape cultivars ranged from 14.6% (Clairatte) to 19.0% (Medot, Sauvignon Blanc), with an average value (17.83 ± 1.31). With regard to mono-saccharides, the values ranged from 14.46% (Alicante Bouchet) to 17.5% (Medot), with an average value (16.25 ± 1.00). Highest total sugars (19.0%) were recorded in Medot& Sauvignon cultivars followed by Syrah cultivar (18.94%) and Cabemet Sauvignon cultivar (18.9%).

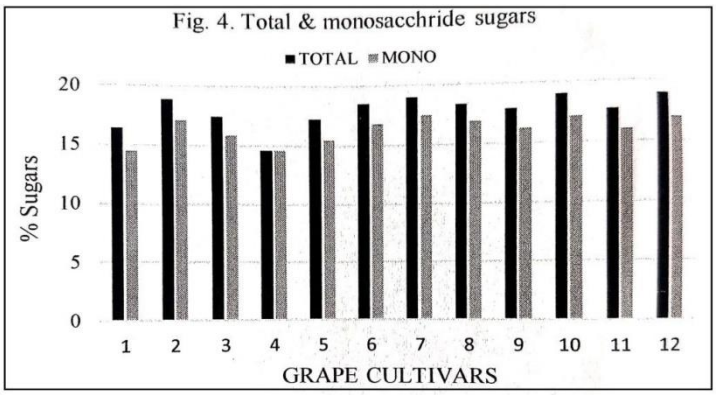
Pheno-Physiological Characters

Sap flow for these cultivars started form February 22 (Merlot) to March 23 (Carbemet sauvignon, Grenache, Sauvignon blanc), the period of sap flow was 30 days. The budburst period began from April 1 (Grenache, Merlot) to April 5 (Carbemet sauvignon, Pinot blanc). The interval between budburst and start of maturity of these cultivars ranged from (94) days (Alicante Boucher) to (122) days (Grenache), as shown in table 7; figure 5 & 6. The budburst started from April 1-10 for all cultivars during season 2014-2015 (Table 8).

Table6. *Chemical Analysis of berries juice*

Cultivars	Dry matter (%)	TDS (%)	Acidity (%)	% Sugars	
				Total	Mono
1	18.82	16.89	0.35	16.40	14.46
2	21.02	19.60	0.56	18.90	17.07

3	19.78	18.28	0.48	17.45	15.85
4	18.80	16.80	0.35	14.60	14.60
5	19.65	17.84	0.25	17.25	15.45
6	21.01	19.21	0.38	18.52	16.79
7	21.02	19.70	0.37	19.00	17.50
8	21.16	19.38	0.33	18.34	16.92
9	20.06	18.64	0.34	17.87	16.23
10	20.76	17.45	0.36	19.00	17.14
11	20.00	18.38	0.37	17.65	15.97
12	21.70	19.30	0.57	18.94	16.98
	20.31 ± 0.94	**18.45 ± 1.04**	**0.396 ± 0.099**	**17.83 ± 1.31**	**16.25 ± 1.00**



The blooming time of these cultivars occurred between May 05 (Sylvaner) to May 11 (Carbemet Sauvignon) and ends between May 12 (Alicante Bouchet) to May 21 (Cinsaut). The blooming period ranged from 8-10 days. The interval between start of blooming and start of maturity of these cultivars ranged from 64 and 88 days for Syrah and Pinot blanc cultivars, respectively, as shown in table 7, figure 5 & 6. Fruit set started from May 09 (Alicante Bouchet) to May 17 (Cinsaut) for these cultivars and ends between May 18 (Alicante Bouchet) to May 25 (Carbemet sauvignon, Cinsaut). The number of days between starting and ending of fruit set ranged from 8 to 10 days. Maturity of grape cultivars can be divided into 3 groups: Very early Mature Cultivars (27/6 to 10/7): Syrah, Alicante Bouchet. Early Mature Cultivars (12/7 to 28/7): Cinsaut, Clairatte, Merlot, Sylvaner, Muscat Petit Grain, Carignan. Medium Mature Cultivars (2/8 to 7/8): Piont Blanc, Cabemet Sauvignon, Grenache, Sauvignon Blanc.

Table7. *Phenological Stages of grape cultivars under study*

Cultivars	Sap Flow	Bud Burst	Blooming Date		Fruit Set		Start of Maturity
			Start	End	Start	End	
1	24/2	4/4	5/5	12/5	9/5	18/5	8/7
2	24/3	5/4	11/5	19/5	17/5	25/5	2/8
3	22/3	2/4	8/5	16/5	13/5	21/5	24/7
4	23/3	3/4	11/5	21/5	17/5	25/5	27/7
5	23/3	4/4	8/5	17/5	14/5	21/5	27/7
6	24/3	1/4	9/5	17/5	13/5	20/5	3/8
7	22/2	1/4	5/5	14/5	11/5	21/5	21/7
8	23/3	2/4	7/5	15/5	12/5	20/5	16/7
9	23/3	5/4	6/5	13/5	12/5	19/5	2/8
10	24/3	3/4	10/5	20/5	16/5	25/5	3/8
11	22/3	1/4	4/5	13/5	10/5	19/5	22/7
12	23/3	2/4	7/5	16/5	13/5	20/5	11/7

Table8. *Bud burst, blooming, fruit set & start of ripening dates during seasons 2014/2015*

Cultivars	Bud Burst		Blooming		Fruit set		Start of Ripening	
	2014	2015	2014	2015	2014	2015	2014	2015
1	April4-9	April1-4	May5-9	May1-5	May9-18	May4-9	July08	July03
2	April5-10	April1-5	May11-15	May5-11	May17-25	May12-17	July02	July08
3	April2-7	April2-9	May8-12	May4-8	May13-21	May8-13	July24	July20
4	April4-9	April1-4	May8-14	May3-8	May14-21	May9-14	July27	July22

5	April3-8	April3-9	May11-16	May5-10	May17-25	May7-12	July27	July22
6	April1-5	April1-7	May9-12	May4-9	May13-20	May8-13	July03	July01
7	April1-5	April1-7	May5-10	May5-31	May11-21	May6-11	July21	July15
8	April2-6	April1-7	May7-11	May2-7	May12-20	May6-12	July16	July11
9	April5-9	April1-5	May6-10	May1-6	May12-19	May6-12	July02	July02
10	April3-8	April3-8	May10-15	May5-10	May16-25	May11-16	July01	July03
11	April1-6	April3-8	May4-10	May4-31	May10-19	May5-10	July22	July18
12	April2-7	April3-8	May7-10	May2-7	May13-20	May8-13	July15	July10

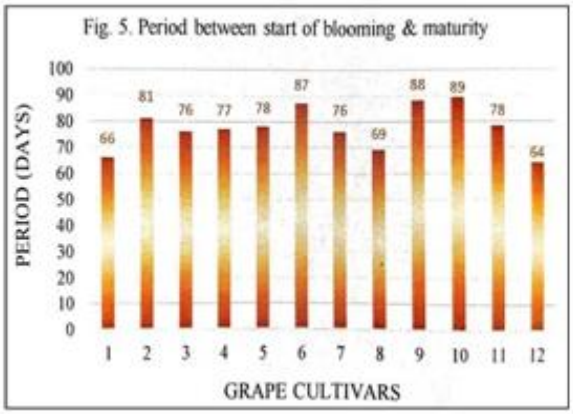


Fig. 5. Period between start of blooming & maturity

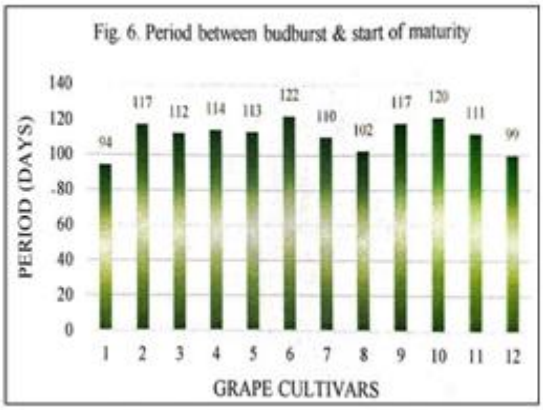


Fig. 6. Period between budburst & start of maturity

Conclusions

In general, the results showed that these different grapevine cultivars offer satisfactory and typical phenological characteristics during growth and at maturity, in relation to the classical table varieties growing regions of the world, showing a good adaptation to the cultivation location, Massa Elbeda, Libya.

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