PRODUCTION AND PERIODICITY CHARACTERISTICS OF SOME OLIVE CULTIVARS (OLEA EUROPAEA L) IN VLORA ENVIRONMENTAL CONDITIONS

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Abstract

44 olive cultivars were studied for their morphological and technological characteristics in Vlora area conditions, during a 12-year period (1993-2005). The main indices studied were the cultivar adaptability in the growing area and regularity of its initial production. Olive cultivars have shown significant changes with regard to their efflorescence and first production. Cultivars like, Manzanilla, Pendolino, Koroneiki, Amigdanolia started their first production during the second year whereas other cultivars like Unafka, Boçi, Kallmet, KME, KMB, Kaninjot, B. TIR, Kushan, H. Himara, Nisiot, Marks started their first production from the 5th to 7th year. Regarding the CP analysis, cultivars were classified according to their diversity level below and above the threshold 0.3. The values of coefficient of periodicity (CP) analyzing the *cluster average linkage method*, showed three groups with similarities: (i) 16% of cultivars with alternation coefficient 0.09 to 0.30; (ii) 32% of cultivars with alternation coefficient 0.30-0.45; (iii) 52% of cultivars with alternation coefficient over 0.45. This means that production of the third group was without uniformity.

Key Words: cultivar; indicator; Soxhlet; efflorescence; rooting; ovary

1. Introduction

Vlora's farmers have preserved and inherited century-old olive trees along with their biodiversity. Identification of olive genetic traits, genotypes adaptability in different environments, and their oil quality have been a long term objective of Olive Research Institute. Olive's first collection was created in 1972 by Sc.Co. T. Nini. The Olive Collection in "Shën.Vasil", was created in 1984 by Sc.Co. V. Anagnosti. Genetic Resources Fund of Olive was established in 1992, with 44 varieties in a modern station multiplication at "Pus Mezini", while in 1996 a new collection comprising 65 varieties of olive was established in Shamogjin under Italy-Albania bilateral project. [5]. The focus of this study was the evaluation of the pomologic characteristics of 44 olive cultivars of Genetic Resources Fund, and their adaptability in Vlora area.

2. Material and Methods

Research was carried out for 44 olive varieties in the Genetic Resources Fund of Olive, which included the period from planting date in 1992 until 2005. Research methodology was based on the descriptions

defined by the project named "The PROJECT RESGEN 96/9COI-CE": [10]

(i)*Morphological characteristics* which consisted of: trees, leaf, efflorescence, fruits and endocarp.

(ii) *Physiological traits*: rooting capacity, ovary's abortion, ripening period, ripeness, fruit bonding.

(iii) *Technological traits*: period without productivity, percentage of fat, yield, and its periodicity. Olive yield was harvested at fruit maturity which usually coincides with the period 5-10 December, and was expressed in kg/tree/year. Calculation of production through the periodicity coefficient (CC) was based on Pearce and Dobersek-Urbank formula: $I = \frac{1}{n-1} * \frac{P(i) - P(i-1)}{\sqrt{P(i) + P(i-1)}}$

Where **n-** represents the number of observations, or weighing and **P** (i) production of the year (i).

(iv) *Phenological phase*. The field was homogeneous, and each cultivar was represented by two trees. The observations which had measurements, weight or description, were carried out on a minimum of 30 bodies. Vegetative growth was estimated for 100 sprigs distributed uniformly in the volume of the tree crown. Leaf morphology was evaluated in 100 fully developed leaves; efflorescence monitoring was based on 50 inflorescences distributed in the middle part of the sprigs. Observations pertaining to fruit as well as to endocarp weight and quality were conducted in 100 fruits taken uniformly in four sides of the tree. The oil content was evaluated through extraction with Ether Petroli in Soxlet. [9]

The above mentioned variables are analyzed according to the program SAS users guide; SAS/STAT, version 2008. SAS Institute Inc. Cary, N.C. [10].

3. Results and Discussion

Our study has been able to recognize and expose several valuable characteristics in terms of pomologic features and above all yield periodicity. Cultivars screening through analysis of variance, confirmed differences in vegetative growth, first olive yield, coefficient of periodicity, oil content, fruit characteristics, etc.

Development phases

Cultivars have different thermal constants, therefore time for buds differentiation, vegetation, efflorescence, fruit fall, and ripening have significant differences and depend on ($Kt = t\text{-}t^{0}$) necessary to complete the vegetative cycle. Differences in thermal constants result in biological differences, yield and periodicity. Patumi M et al. 1999 [8] report that cultivars had intensive vegetative growth in the early years, and the crown volume was different for each cultivar. Olive genotypes with early fructification were associated with less vegetative growth whereas those with no or late fructification had a more intensive vegetative growth. [8]

Table 1: Main characteristics of cv. olive, (Pus Mezini, Vlore)

Nr	*CV*	*Fruit (gr)*	*Endocarp (gr)*	*Ratio (T/B)*	*Fruit (D/d)*	*% Pulp*	*5 years Average. Kg//root*	*Oil (%)*	*Year of entry in production*	Periodicity index
1	Pikual	3.0 **KLM**	0.53	4.5	1.4	82.3	15.3	22	3	0.41 **cdefghij**
2	Amfisa	6.5 **D**	0.6	9.8	1.2	90.0	12.6	20.3	3	0.48 **ghijkl**
3	Kripsi i Krujes	3.6 **HI**	0.5	5.9	1.0	86.1	7.0	19.4	3	0.67 **fghijkl**
4	Ulliri i kuq	2.16 **P**	0.43	4.0	1.3	80.0	1.5	22.2	3	0.88 **efghijk**
5	Mastoidhis	2.1 **P**	0.34	5.3	1.5	84.0	13.1	20.6	3	0.34 **fghijkl**
6	Pendolino	2.8 **M**	0.57	3.9	1.5	79.5	19.0	20.3	2	0.33 **jkl**
7	Lecino	2.8 **M**	0.52	4.3	1.4	81.4	24.5	17.9	3	0.12 **ijkl**
8	Lukova/2	3.3 **JKL**	0.39	7.4	1.2	88.2	11	23.5	4	0.56 **cdefgh**
9	Lukova/5	3.2 **JKL**	0.38	7.4	1.2	88.1	13.4	25.5	3	0.77 **efghijk**
10	Lukova/3	3.4 **IJK**	0.43	6.9	1.1	87.4	15.2	25.0	4	0.39 **cdefghij**
11	Askolana	8.4 **B**	0.63	12.3	1.5	92.5	10.4	12.6	3	0.35 **hijkl**
12	Grosso di spanja	8.7 **A**	0.71	11	1.2	91.8	18.0	14.4	3	0.58 **hijkl**
13	Manzanilla	3.9 **G**	0.47	7.2	1.2	88.0	21.0	22.5	2	0.24 **l**
14	I bardhi Krujes	2.13 **P**	0.37	4.7	1.4	82.7	13.8	21.1	4	0.55 **defghij**
15	Leukokarpa	1.7 **Q**	0.44	2.8	1.4	74.1	9.5	16.6	4	0.78 **abcdefghijkl**
16	Gordal	8.8 **A**	0.76	10.5	1.3	91.4	6.8	12.4	4	0.45 **defghij**
17	Halneiqis	5.7 **E**	0.68	7.3	1.4	88.0	3.5	15.8	4	0.59 **hijkl**
18	Kukurela	2.8 **M**	0.3	8.3	1.3	89.3	8.0	23.2	4	0.71 **cdefg**
19	Koroneiki	1.1 **R**	0.21	4.2	1.6	80.0	20.5	21.8	2	0.09 **kl**
20	Amigdanolia	8.3 **B**	0.78	9.6	1.5	90.6	4.4	15.5	2	0.23 **kl**
21	Unafka	2.17 **OP**	0.45	3.8	1.3	79.3	3.5	14.7	6	0.67 **abc**
22	Boci	3.3 **JKL**	0.48	5.9	1.1	85.5	1.8	21.5	6	0.87 **abcd**
23	Kallmet	3.7 **GHI**	0.38	8.7	1.3	89.7	0.8	18.0	5	0.88 **abcd**
24	Karolea	4.66 **FH**	0.63	7.3	1.33	86.4	9.4	24.4	5.2	0.53 **defghij**
25	Gjykatesi	3.8 **GH**	0.58	5.5	1.1	84.7	4.5	16.6	5	0.66 **abcd**
26	Koratina	4.3 **F**	0.66	5.5	1.1	84.6	16.4	21.5	3	0.33 **ghijkl**
27	Managjel	3.5 **IJ**	0.55	5.3	1.2	84.3	3.7	17.7	4	0.66 **cdefgh**
28	Karboncela	1.7 **Q**	0.32	4.3	1.4	81.2	5.5	14.4	3	0.37 **ghijkl**
29	KME	3.6 **HI**	0.55	5.5	1.1	85.0	2.8	20.0	5	0.71 **efghijk**
30	Kotruvsi	2.8 **MN**	0.48	4.8	1.3	82.8	13.7	22.2	3	0.36 **fghijkl**
31	Nivica 1	2.9 **M**	0.31	8.3	1.2	89.3	6.0	23.4	3	0.44 **fghijkl**
32	Mixan	2.2 **OP**	0.38	4.8	1.2	82.7	4.8	26.2	3	0.34 **fghijkl**
33	KMB	7.5 **C**	0.67	10.1	1.3	91.1	3.1	17.2	5	0.48 **abcde**
34	Kalinjot	3.9 **G**	0.45	7.6	1.1	88.5	6.8	27.2	5	0.50 **abcde**
35	Pulazeqin	2.3 **NOP**	0.44	4.2	1.5	80.9	14.1	22.4	4	0.26 **efghijk**
36	B.Tir	2.2 **OP**	0.33	5.6	1.3	85.0	4.8	27.0	5	0.48 **bcdefg**
37	Cunatis	2.4 **NO**	0.29	7.2	1.4	88.0	13.8	29.6	3	0.30 **ijkl**
38	Kallamon	3.8 **GH**	0.45	7.4	1.6	88.2	8.8	20.7	4	0.67 **cdefghi**
39	Freng	2.1 **P**	0.52	3.0	1.4	75.2	9.5	29.5	5	0.44 **abcd**

40	Kusha	2.27 **OP**	0.35	5.4	1.4	84.6	11	28.3	5	0.40 **abc**
41	H.Himara	1.6 **Q**	0.33	3.8	1.6	79.4	10.7	17.7	5	0.43 **bcdef**
42	U.zi	2.77 **M**	0.46	5.0	1.5	79.7	14.0	21.1	4	0.31 **cdefghi**
43	Nisiot	2.4 **NO**	0.47	4.1	1.3	80.4	3.7	24.4	7	0.58 **a**
44	Marks	3.0 **LM**	055	4.4	1.1	81.7	8.0	22.3	6	0.59 **ab**

Levels not connected by same letter are significantly different.

Figure 1: The Genetic Fund Resources of the Olive, (*Pus Mezini Vlore*)

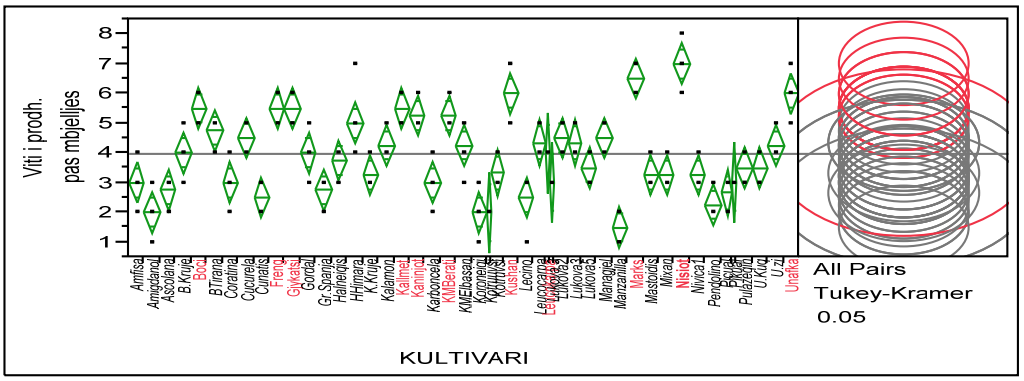

Figure 2. Dendogram for the first year production by Cultivars

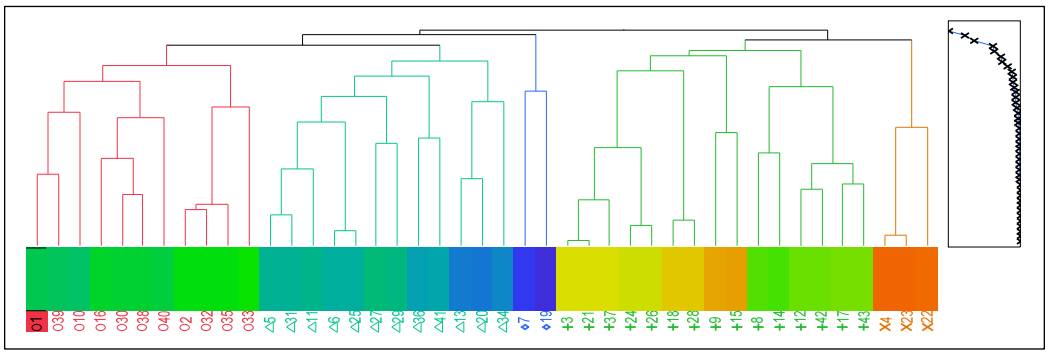

Figure 3:, Dendogram of olive cultivars similarity for the coefficient of periodicity (CP)

Unproductive period .

Production, as the metabolic activity of the tree depends on cultivar's genetic nature and its ability to fructify after reaching the equilibrium (C / N). Visible expression of this relation was the beginning of the first production, its productivity and distribution in the successive years. The start of production is a quality phenomenon, and is related to the ecosystem, while the amount of production depends on the fructification surface. [2]. The unproductive period of cultivars analyzed through Anova Test - tukey-cramer) grouped cultivars according to the level of changes in four homogeneous groups (*Fig 2 & Fig 4*): (i) cultivars that started production after 1.5 -3.3 years, among which we *Manzanilla, Pendolino, Koroneiki, Amigdanolia.* (ii) cultivars that fructified after 3.5 – 4 years, while other groups include: (iii) Cultivars that started production 4-5 years after planting; (iv) 5-6.5 years after planting and (v) cultivars that started their production seven years after planting. Cultivars that started production after more than 6-7 years were not economically viable to establish new olive groves. [2]

Periodicity of production.

Cultivars yield regularity was influenced by genetic factors. However soil and climatic conditions remain important factors in yield periodicity [2]. Periodicity coefficients (CP) were calculated for each year according Dobersenk-Urbank formula. CP values were analyzed with anova test (tukey-kramer) and cluster averages identified dominant values, separation into groups based on proximity and distance between the values, as well as dominant cultivars for low coefficient of periodicity. We concluded that yield periodicity was constant up to the limit 0.3 of CP, in which only seven or 13.6% of cultivars possess were included. 15 cultivars (or 34% of them) had CP within the range 0.3-0.45 which represents an average level of periodicity. In *fig 3* we observed homogeneous groups as well as cultivars with different CP. Seven cultivars with CP value under 0.3 are known for known for their constant production in different years. In the second axis there are 15 cultivars with CP from 0.3 to 0.45 which showed relatively homogeneous production.

Periodicity coefficient is considered an adjustment marker of genetic diversity in the ecosystem and analytical presentation has distinguished three groups (*Fig. 3*).

(i). Cultivars with periodicity coefficient 0.09-0.30: *Lecino,Manzanilla, Amigdanolia, Koroneki, Pulazeqin, Cunatis, and Ulli i zi.* (ii). Cultivars with periodicity coefficient 0.30-0.45: *Pikual, Ulli i kuq, Mastoidis, Lukova-3, Ascolana, Leucocarpa, Koratina, Karboncela, Kotruvsi, Mixan, Nivica 1, KMB, Kalinjot, B. Tirana, Freng, H.Himara, Kushan.* (iii). Cultivars with periodicity coefficient larger than 0.45 were those which are not included in the above two groups. The production of these cultivars was without uniformity. These types comprise 52% of all cultivars in the study **[7]**.

Fruit and endocarp

The average fruit weight showed differences among varieties for the resulting distance. Based on the pomological criteria: average fruit weight, pulp/endocarp ratio, oil content anova test was carried out for analysed samples. In table 4 four groups were distinguished with fruit weight: [9]

(i) Cultivars with small fruit (<2g): This group includes cultivars *Koroneiqi, Himara, Karboncela, and Leucokarpa* intended to produce oil and comprise 9%. (ii) Cultivars with average fruit: (2-4g) constitute 72%. These cultivars are: Picual, Kr.Krujes, U.Kuq, Mastoidis, pendolino,Lecino,, Luk-3, Luk-2, Luk-5, Manzanilla,, B.Krujes, Kukurela,Unafka, Boc, Kallmet, Gjykatsi, Managjel, KME, Kotruvsi, Nivica-1, Mixan, Kaninjot, Pulazeqin, B.Tiran, Cunatis, Kallamon, Freng, Kusha, U.Zi, Nisiot, and Marks. These cultivars have dual use: for oil and table, but mainly for oil. (iii) Cultivars with large fruits (4-6g) are two: Halneiqis and Koratina. (iv) Cultivars with considerably large fruit (>6g): are Amfisa, Askolana, Grosso di Spanja, Gordal, Amigdanolia, KM.Berati. The cultivar Koroneiqi has very small weight fruits (1.1g), while the cultivar Gordal has very high weight fruits (8.8g) followed by cv. Grosso di Spagna (8.7g). [10]

The percentage of pulp:

According to table Nr 1**,** cultivars had characteristic fruit: endocarp ratios *[4]*. Considering the percentage of pulp cultivars are classified into four groups: (i) excellent (>90%), (ii) very good (85-90%), (iii) good (80-85%), (iv) poor (< 80%).

Cultivars Gordal, Grosso Spanja, Ascolana, Amigdanolia, KMBerati, Amfisa result very rich in pulp, with over 90%, while the fruits of cv: Leukokarpa, Freng, Unafka, Uzi, Himara have pulp rates below 80%. Fruits of cv. Ascolana, Grosso di spanja, KMB, Amigdanolia that have fruit weight over 6g and pulp rate 90% correspond to low to medium oil content. While cultivars with weight under (2g) and pulp rate under 80% have low-oil content. Cultivars with average weight of fruit (2-4 g) had higher oil content and double use [1].

Caliber of the fruit.

The ratio between transversal diameter (D) and (d) was different and is characterized by the form of fruit. Endocarp is used as a marker of varietal identity because it constitutes the most stable morphological feature [3].

Oil content

Oil content, analyzed as a percentage of the fresh material is a very important indicator for the purpose of oil cultivation in oil production. [8]. Comparison of oil percentages has been of great variability. Cultivars are listed in three classes in relation to this trait: (i) low, (<18%). (ii) average (18-22%), and (iii) high oil content (>22%). In most of the cases oil percentage is between

12.4% and 29.6%. Variety Cunatis, had the highest oil percentage (29.6%). Thus, it can be said that varieties Kaninjot, Kushan, Freng, BTiran, Mixan yielded very good oil content (26-28%) whereas other varieties such as Himar, Pzeqin, Gordal, Askolana, Unafka, Karboncela etc. had low oil content. In table nr 4 30% of olive cultivars had low percentage of oil, 27% average oil content (18-22%) while 42% of them had high oil 9876content (>22%) [1] [2].

4. Connclusion

- Being aware of the olive genetic diversity tested in Vlora environmental conditions, we conclude that multiplication and propagation of olive cultivars with desirable characteristics would increase varietal diversity, unlike the past when three cultivars only (Kalinjot, Himara, Pulazeqin) dominated olive varietal structure. We should increase the olive grove acreage for cultivars with short unproductive period (2-3 years) and especially for those with genetic features expressed in the coefficient of periodicity (CP 0.09-0.3).
- In terms of Vlora environmental conditions, four cultivars have manifested high constant production:
  - 0.09-0.12 (Pendolino, Manzanilla, Koroneiqi, Amigdanolia), after which rank cv: Koratina,
  - Karboncela, Kotruvsi, Mixan, Pulazeqin, Cunatis, Black olive, Nivica 1, KMB, Kalinjot, B.
  - Tirana, Freng, H. Himara, Kushan with a very good periodicity coefficient (0.2-0.3).

5. References

1. Jimenez A, Uceda M: **Characterisation of virgin olive oil of Italian olive cultivars**: *'Frantoio' and 'Leccino', grown in Andalusia.* Food Chem 2005, 89: 387–391
2. Baratta B, Caruso T, Di Marco L, Inglese P: **Effects of irrigation on characteristics of olives in 'Nocellara del Belice' variety**. Olea 1986, 17: 195-198.
3. Belaj A., Zlatko S., Ismaili H., Panajoti Dh., Rallo L: **RAPD genetic diversity of Albanian olive germoplasm and its relationships with other Mediterranean countries**. Euphytica 130. 2003, 387-395
4. European Union Commission: **Characteristics of olive oil and olive pomace and their analytical methods.** *Regulation EEC 2568/91 and latter modifications.* Official J. Euro. Communities L248, 1991, 1-82.
5. Ismaili H, Celoaliaj Q: **Alcuni aspetti dell'Olivicoltura Albanese**. *Atti del convegno L'olivicoltura Mediterranea.* 1995, 85-92.
6. Ismaili H: **Etude des caracteristiques pomologiques des cultivars plus importants de l'olivier en Albanie.** *Atti del convegno L'olivicoltura Mediterranea.* 1995, 115-122.

7. Dodona E, Ismaili H.,Cimato A, Vorpsi V, Imeri A. **Administration of biodiversity of the autochtones olive trees in Albania.** Timisuoara Romania, CSVUSH, 2009, 5-11
8. Patumi M, D'Andria R, Fontanazza G, Morelli G, Giorio P, Sorrentino G.: **Yield and oil quality of intensively trained trees of three cultivars of olive (*Olea europaea* L.) under different irrigation regimes.** *J. Hort. Sci. Biotechnol*. 1999,74: 729-737.
9. AA.VV**. Metodologia per la descrizione delle varieta di olivo**. 1997.
10. *Progetto RESGEN 96/9, COI – CE (documento COI)*
11. SAS users guide; **SAS/STAT,** version 2008. SAS Institute Inc., Cary, N.C