International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 4, Issue 3 (March 2015), PP.32-38

The interaction with season collection of cuttings, Indol Butyric Acid (IBA) and juvenility factors on root induction in olea europaea L.(Cultivar "Kalinjot")

Adhurim Lazaj[1], Petrit Rama,[2] Hekuran Vrapi[3]
[1]PhD Candidate, Agricultural University of Tirana, Department of Horticulture, Agricultural University Of Tirana, Albania
[2]Department of Horticulture Faculty of Agriculture & Environment, Agricultural University Of Tirana, Albania
[3]Department of Plant Protection, Faculty of Agriculture & Environment, Agricultural University of Tirana, Albania

Abstract:- Differences in the root ability of olive cuttings in the juvenile and mature form are reported. The root ability of cuttings from juvenile and mature olive shoots together with the influence of season stem collection and different concentrations of IBA has been studied. Shoot proliferation and rooting of the olive explants were improved with editing to the nutrient media of 20 mg/l and 50 mg/l crude extract from olive ovule, respectively. Also, it is found that the extract of olive ovule has high content of IAA
That means that shoots coming from the olive ovule located at the base of the tree have juvenility factors. Leafy stem cuttings of olive cultivar "Kalinjot" were obtained from 1-year-old olive shoots sampled on March 25th, April 15th, August 1st and September 1st during the 2013 growing season. The shoots were collected from the olive ovule located at the base of the tree (juvenile form) and on the crown of the tree (mature form) To improve the rooting of olive cuttings, different concentrations of IBA , (0,2000,4000,dhe 6000 ppm)
After treatments, the stem cuttings, equipped with an automatic mist system, were planted in the greenhouse. 60 days after the beginning of rooting treatments, cuttings were scored for the presence of callus, percentage of rooted cuttings, root number per cutting and root length. In all the seasons and all the concentrations of IBA the juvenility modified significantly higher rooting of cuttings.
The percentage of rooted cuttings sampled on April 15th was markedly greater than that of rooted cuttings sampled on the other seasons. The concentration 4000 ppm of IBA was better.

Keywords:- olive, root, shoot, juvenility, Indol Butyric Acid.

I. INTRODUCTION

The asexual proliferation with the added technique with nebulism of the olive since after the second half of the last century has contributed in the growing of the olive nurseries efficiency. The genetic uniformity of the produced saplings, the option of realization of the growth cycles per year, the cost reduction, the health insurance, the balance of root system development root/system , are advantages of this growth manner compared to the growth with seed.[4,5,9,16] Rugini et al (1990) reported that the biggest problem in vegetative propagation, in some olive cultivars, is the low ability of regeneration leading to low percentage of rooting. In this research we used cultivar Kalinjot, an important variety for Albania with dual use.(oil and fruit).

Higher plants progress through different growing phases during their post-embryonic development. The shoot undergoes an aging process recorded as the variation in characters or structures along the axis from the juvenile to the adult stage [7,19,20,21,22]. The juvenile period is the time during which a plant coming from seeds cannot be induced into flower; [14,15] and it is therefore unproductive under natural growing conditions.
The phase of juvenility characterizes the maximize of rooting capacity [9,28]. Increasing of rooting capacity of cuttings of juvenile plants probably due to the presence of large concentrations of auxins [1,6,9]. Shoot proliferation and rooting of the olive explants were improved by the addition to the nutrient media of 20 mg/l and 50 mg/l crude extract from olive ovule, respectively. Also, it is found that the extract of olive ovule has high content of IAA [23,24]. That means that shoots coming from the olive ovule located at the base of the tree have juvenility factors.

For some woody plants which are shy rooting, cuttings taken in the juvenile stage often root more easily than those taken from mature plants.[25,29]

This experiment aimed at increasing the rooting ability of olive cuttings of this variety using cuttings from different ontogenetic phases with different concentrations of IBA in different seasons of the year

II. MATERIAL AND METHOD

On March 25, April 15, August 01, and September 01, during the 2013 growing season, in the sector of olive tree collection of the experimental base, located in Shamogjin (A.T.T.C. at Vlore) were taken leafy stem cuttings (15-20 cm long each cuttings) from one year semi hardwood saplings of the cultivars " Kalinjot .The shoots were collected from the olive ovule located at the base of the tree (juvenile form) and from crown of the tree (mature form)

Leafy stem cuttings with four leaves were prepared in the morning and their bases were dipped for 7 sec in solution of different concentration of IBA as follows:

Experiment one: March 25th

Cutting of Mature Form	Cuttings of Juvenile Form
1st treatment 0ppm IBA	1st treatment 0ppm IBA
2nd treatment 2000ppmIBA	2nd treatment 2000ppmIBA
3rd treatment 4000ppmIBA	3rd treatment 4000ppmIBA
4th treatment6000ppmIBA	4th treatment6000ppmIBA

Experiment two: April 15th

Cutting of Mature Form	Cuttings of Juvenile Form
1st treatment 0ppm IBA	1st treatment 0ppm IBA
2nd treatment 2000ppmIBA	2nd treatment 2000ppmIBA
3rd treatment 4000ppmIBA	3rd treatment 4000ppmIBA
4th treatment6000ppmIBA	4th treatment6000ppmIBA

Experiment three: August 1st

Cutting of Mature Form	Cuttings of Juvenile Form
1st treatment 0ppm IBA	1st treatment 0ppm IBA
2nd treatment 2000ppmIBA	2nd treatment 2000ppmIBA
3rd treatment 4000ppmIBA	3rd treatment 4000ppmIBA
4th treatment6000ppmIBA	4th treatment6000ppmIBA

Experiment four: September 1st

Cutting of Mature Form	Cuttings of Juvenile Form
1st treatment 0ppm IBA	1st treatment 0ppm IBA
2nd treatment 2000ppmIBA	2nd treatment 2000ppmIBA
3rd treatment 4000ppmIBA	3rd treatment 4000ppmIBA
4th treatment 6000ppmIBA	4th treatment 6000ppmIBA

After treatments, the stem cuttings were planted in greenhouse equipped with an automatic moist system. The layout of experimental design was completely randomized with 4 replications of 50cuttings per treatment. Cuttings were evaluated 60 days after planting for percentage of rooted cuttings, primary root number and mean primary root length.

III. RESULTS AND DISCUSSION

As it can be seen in Table I the olive var. Kalinjot is one of easiest to-root cultivars respectively to vegetative propagation from leafy stem cuttings. The percentage of rooting without IBA and with different concentrations of IBA showed that this cultivar has good rooting abilities. The percentage of rooted cuttings sampled on March 25th and April 15th was markedly greater than those sampled on the other seasons (August 1st and September 1st). The concentration 4000 ppm of IBA results with better percentage of rooting. The effect of juvenility on root induction was significant in all the seasons and in all the concentration of IBA. The combination of juvenility with concentration of 4000ppp IBA and the month of April has the best results (71.5%) on root induction of cuttings of olive cultivar" Kalinjot"

Table I. Effect of season collection of cuttings, Indol Butyric Acid (IBA) and juvenility factors on root induction in Olea europaea L.cv, "Kalinjot"(rootting %)

Factor A	Factori B	Factori C	r1	r2	r3	r4	Mean
Mature	March	0 IBA	4	0	8	6	4.5
		2000 ppm IBA	22	36	46	30	33.5
		4000 ppm IBA	61	70	56	46	58.25
		6000 ppm IBA	50	58	30	52	47.5
	April	0 IBA	6	4	8	2	5
		2000 ppm IBA	34	38	32	50	38.5
		4000 ppm IBA	80	66	54	46	61.5
		6000 ppm IBA	56	52	62	40	52.5
	August	0 IBA	4	4	0	2	2.5
		2000 ppm IBA	16	20	14	12	15.5
		4000 ppm IBA	18	24	38	18	24.5
		6000 ppm IBA	14	22	34	26	24
	September	0 IBA	6	4	4	2	4
		2000 ppm IBA	14	12	4	20	12.5
		4000 ppm IBA	24	16	10	22	18
		6000 ppm IBA	26	18	18	24	21.5
Juvenility	March	0 IBA	12	2	6	6	6.5
		2000 ppm IBA	54	42	38	48	45.5
		4000 ppm IBA	94	44	82	50	67.5
		6000 ppm IBA	38	76	70	66	62.5
	April	0 IBA	10	6	18	12	11.5
		2000 ppm IBA	30	56	44	48	44.5
		4000 ppm IBA	78	92	64	52	71.5
		6000 ppm IBA	66	88	32	80	66.5
	August	0 IBA	6	8	12	16	10.5
		2000 ppm IBA	22	30	36	14	25.5
		4000 ppm IBA	26	44	32	48	37.5
		6000 ppm IBA	42	28	8	54	33
	September	0 IBA	4	8	6	16	8.5
		2000 ppm IBA	10	14	4	26	13.5
		4000 ppm IBA	28	26	24	16	23.5
		6000 ppm IBA	14	12	20	30	19

Table 2. Analysis of variance (MANOVA) for the factors in study

VS	DF	SS	MS	F
Factor1-F1	1	1898.8203	1898.82031	15.8845 **
Factor2-F2	3	19262.83594	6420.94531	53.7142 **
Factor3-F3	3	28744.21094	9581.40365	80.1529 ** 0.9340
Int. F1xF2	3	334.96094	111.65365	ns 0.2366 ns
Int. F1xF3	3	84.83594	28.27865	6.5498 **
Int. F2xF3	9	7046.63281	782.95920	0.2700 *
Int.F1x2x3	9	290.50781	32.27865	
Treatments	31	57662.80469	1860.09047	15.5605 **
Error	96	11475.75000	119.53906	
Total	127	69138.55469		

** Significative at a level of 1% of probability (p < .01) * Significative at a level of 5% of probability (.01 =< p < .05) ns Non-significative (p >= .05)

The combination of season collection of cuttings, Indol Butyric Acid (IBA) and juvenility factors marked differences in the mean root number per cuttings .The root number per cuttings was higher (4,55 roots per cutting) on cuttings sampled on April 15th from shoots in juvenile form. The best concentration of IBA was 4000ppm. This might be due to the more appropriate temperatures on this season.

Increasing of rooting capacity of cuttings of juvenile phase reported in this paper is in accord with the findings of other researchers [1,3,9,10,13,17,18].The juvenile form that enhanced the number of roots on cuttings of olive probably due to the presence of large concentrations of auxins. Rama, 1989 (23) confirmed that the extract of olive ovule has high content of IAA .

IV. PERCENTAGE OF ROOTED CUTTINGS

Data showed the mean values of percentage of rooted cuttings (Table I). Cuttings treated with 4000 ppm IBA had a higher rooting percentage as compared to 0, 2000, and 6000 ppm IBA. Moreover, rooting percentage nukrritet shume kur the IBA concentration increased ne 6000 ppm. The control treatment (0 ppm IBA) produced a poor rooting percentage (%).

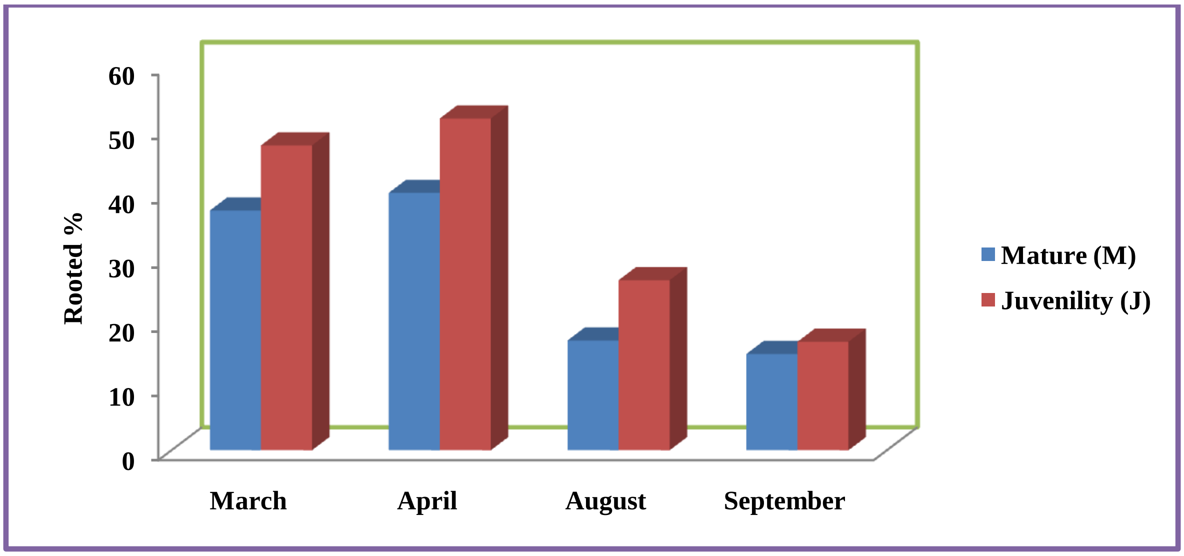

Figure 1. Rootting percent on two different ontologic ages four times in cv.Kalinjot

In figure 1 , from statistical processing we can see that there are significativ differences in the percentage of rooting between two ontogenetic ages. These changes appear in all the time of planting. Greater rooting ability of olive cutting with new ontogenetic age can be caused by content in them greater amounts of hormones and other compounds rooting promoter, compared with inhibitors of this process.

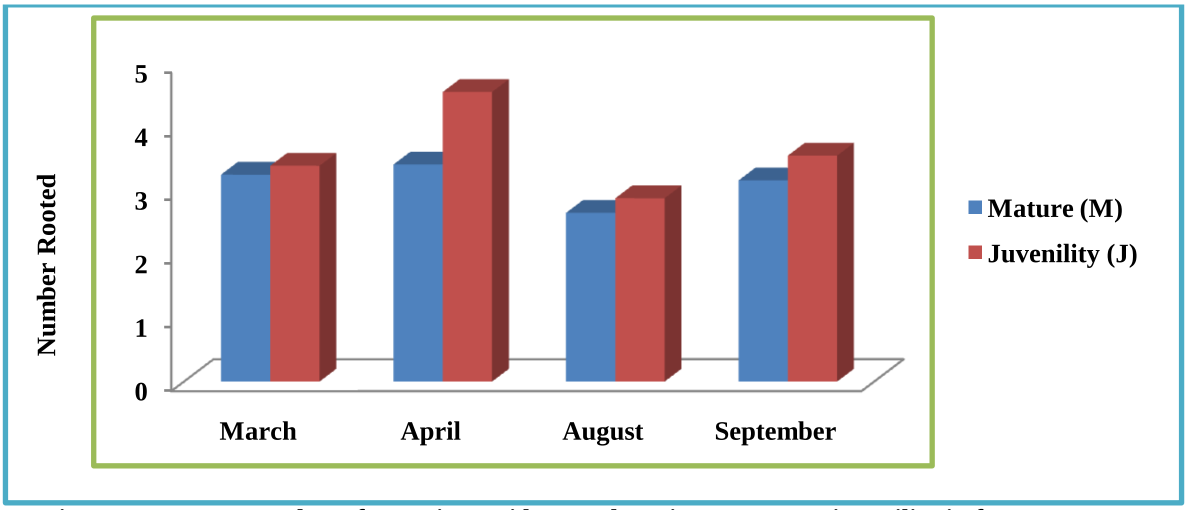

Figure 2.Average number of roots in semi harvood cutting mature vs juvenility in four treatmens IBA concentrations.

IV. AVERAGE NUMBER OF ROOTS PER CUTTING

In figure 2, the highest number of roots per cutting in Mature (M) and Juvenility (J) ontogenetic ages – respectively :(3.41 and 4.55 per cutting) was found with the 4000 ppm IBA treatment, and the lowest numbers (2,08 and 2,1) were found in the control treatment. The results showed that IBA treatment increased the average number of roots per olive stem cutting. A higher number of roots per cutting with 4000 ppm IBA was due to the physiological interaction of IBA and carbohydrates, as reported by Wiesman and Lavee (1995) [30]. They reported that during rooting, photosynthesis in the cuttings is low and has almost no effect on the carbohydrate content. The data suggests that carbohydrates have an important role in root formation and improve the stimulatory effect of IBA in this process. These results are similar with the findings of Wiesman and Lavee (1995) [30,31] reported that higher concentrations of IBA increased root numbers in olive

The data shows that juvenile olive cutting have higher rooting ability and it also manifested to increase the root number of trees per cutting. Promotor rooting factors that has the cutting itself induce a greater number of points primary roots giving greater number of roots in the higher percentage of radication.

Effect of season

The seasonal effect on rooting tip cuttings is shown in figure 1 and 2 showed a high rooting percentage is in April, and the lowest in August or September.

In April , rooting ability of olive cutting from both ages results in the highest. This season is consistent with the vegetative activation of the plant and the start of the new bud growth. This activation changes concentrations relation that induct root factors. Reduction of the rooting in August and September periods must be related to changes occurring in the plant vegetation due to the stem annual cycle of development and influence of stress that exceeds the plant under the influence of high summer temperatures and lower levels of humidity during this period.

Effect of ontologic ages of semi hardwood olive cutting

Our results show that the application 4000 ppm IBA improved the rooting percentage olive cultivars in comparison with control. Auxin is well known to stimulate root formation of the cuttings [11]. Adventitious root initiation in olive cuttings can be stimulated by auxins, particularly indol-3-butyric acid (IBA) [10]

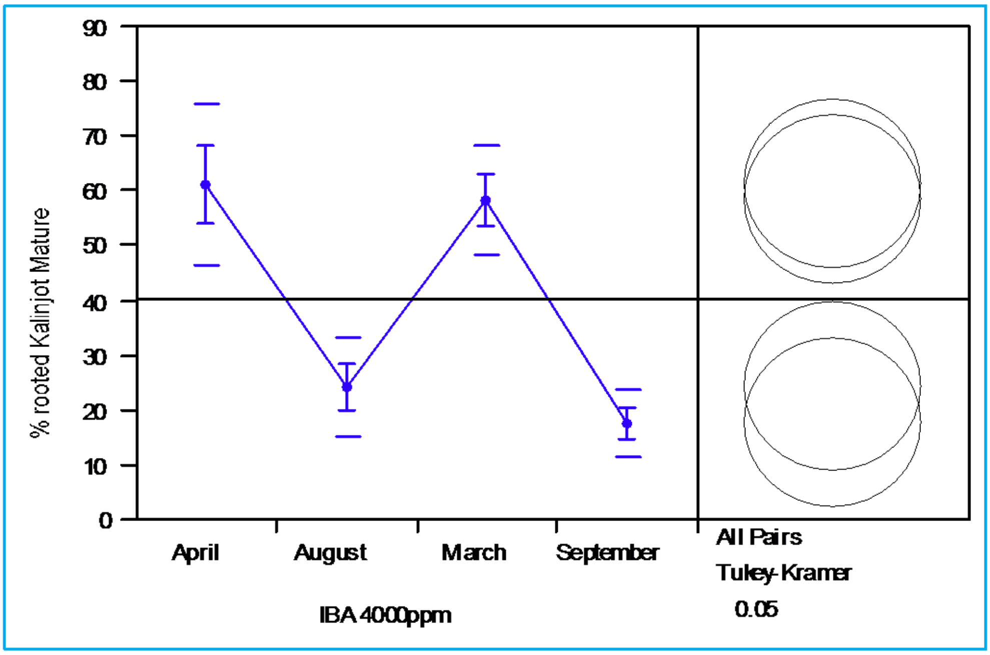

Figure 3 Variance Tukey-Kramer analisys, % rooted 4000 ppm in Mature by seasons

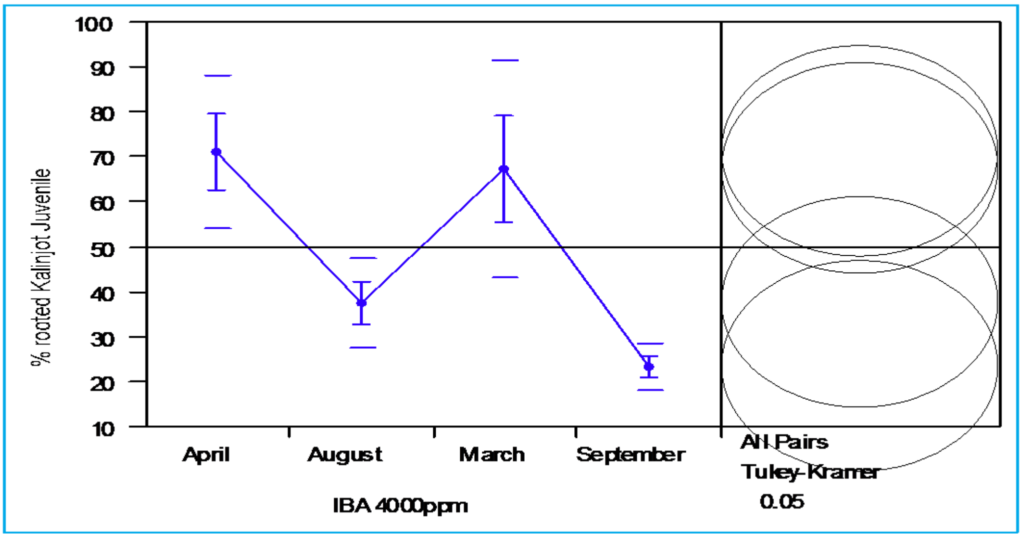

Figure 4. Variance Tukey-Kramer % rooted IBA in Juvenile 4000ppmIBA by season

In figure 3 and 4 the statistical analysis shows that in 4000 ppm, the data are separate in two classes with significant difference: a)the rooting % of March and April; b) the rooting % of August and September. On observe a greater changes in the cutting between Mature(M) and Juvenility(J).

V. CONCLUSIONS

Auxin is well known for stimulating root formation of the cuttings [12]. The most widely used auxin for commercial rooting is IBA, nevertheless, auxins have failed to promote root initiation or they had only a slight rooting effect in the case of hard-to root olive cultivars. There are great differences in the rooting potential among olive cultivars and these have been categorized in to three groups, easy, moderate and hard to-root cultivars [2, 30] . Therefore, the selection of genotype with high rooting ability is of a prime importance. Most olive growers know that a rooting percentage lower than 20% in most cases means that vegetative propagation is not economically viable [30,31]. The majority of the cultivars showed a moderate or low rooting ability even in response to IBA treatment.

As shown in Tables I, rooting in general was lower in control treatments than for any treatment involving a hormone. The results of Rugini et al. (1990) [27] were nearly identical as to the results of our experiments,

The effectiveness of auxin to raise rooting percentage of the cuttings could be explained through increasing cambial activity and differentiation of root primordial tissue or by stimulating redistribution and mobilization of some auxin cofactors towards base of the cuttings.

REFFERENCES

[1]. Arya, S., R. Tomar and O.P. Toky: **Effect of plant age and auxin treatment on rooting response in stem cutting of Proposis cineraria.** J. Arid. Environ. 27: 99-103. 1994

[2]. Avidan B., Lavee S. : **Physiological aspects of the rooting ability of olive cultivars**. Acta Hort., 79: 93-101. 1978.

[3]. Awang Y., Sandrang K., Mohamad R.,Selamat A.: **Effect of ontogenic age on root and shoot development of Tabebuia heterophylla cuttings propagated in soilless culture**. African Journal of Agricultural Research Vol. 6(24), pp. 5422-5427, 26 October, 2011.

[4]. Barba M., Mainolfi P.: **Certificazione volontaria del materiale di propagazione dell'olivo**. L'Informatore Agrario, 52 (11), 65-67. 1996.

[5]. Barranco D. N., Cimato A., Fiorino P., Rallo R.L. Touzani A., Castaneda C., Serafini F., Trujillo I. N. :**Catalogo Mondiale delle Varietà di Olivo. Edizione C.O.I.**, Madrid, maggio, 1 – 360 . 2000.

[6]. Βακουφτσής, Γ. Α.: **Μελέτη του βλαστικού πολλαπλασιασμού των δασικών καλλωπιστικών φυτών Cupressus macrocarpa var. goldcrest και Cupressocyparis leylandii var. castlewellan gold**. Διδακτορική Διατριβή. Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης. PhD Thesis. 2006.

[7]. Casanova L.,Suárez M.P., Fernández-Cabanás V., Morales-Sillero A.,Jiménez M.R.,RalloP.: **From the juvenile to the adult vegetative phase in olive seedlings:the transition along the stem axis**. Spanish Journal of Agricultural Research 2014 12(4): 1149-115. 2014.

[8]. Caballero J.M., Del Rio C.: **Propagacion del olivo por enraizamiento de estaquillas semilenosas bajo nebulizacion**. Junta de Andalucia. Consejeria de Agricultura y Pesca. 2008.

[9]. Fabbri, A., G. Bartolini, M. Lambardi and S. Kailis.: **Olive propagation manual.** Landlinks Press, Collingwood, Australia. 2004.

[10]. Fernandes Serrano, J.M., M.C. Serrano and E.Amaral.: **Effect of different hormone treatments on rooting of Olea europaea cv. Galega vulgar cuttings.** Acta Hort., 586: 875-877. 2002.

[11]. Hartmann H.T.: **The use of root-promoting substances in the propagation of olives by sof -wood cuttings.** Proc Amer Soc Hort Sci 48:303-308. 1990.

[12]. Hartmann H.T., Kester D.E., Davie F.T., Geneve R.L.: **Plant propagation, principles and practices.** Pearson Education, Inc., Upper Saddle River, NJ, USA, 880 p. 2002.

[13]. Χατζηλαζάρου, Σ.Π.:**Μελέτη της ριζοβολίας μοσχευμάτων και μικρομοσχευμάτων γαρδένιας και αζαλέας στο σύστημα ομίχλης.** Διδακτορική Διατριβή. Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης. 1998.

[14]. Meilan R,: **Floral induction in woody angiosperms.** New Forests 14: 179-202. 1997.

[15]. Jones CS,:. **An essay on juvenility, phase change, and heteroblasty in seed plants**. Int J Plant Sci 160(6): 105-111. 1999

[16]. Morini S.:“**Tecniche di propagazione vegetativa e di allevamento in vivaio per la valorizzazione di specie da fronda recisa”**.Dipartimento di coltivazione e difesa delle specie legnose “G. Scaramuzzi” - sezione coltivazioni arboree Universita’ di Pisa

[17]. Moshtaghi E. Asl , Shahsavar A.R.: **The Effects of IBA and H2O2 on Rooting of 2 Olive Cultivars** . Journal of Chemical Health Risks 1(1): 35-38, 2011.

[18]. Osvaldo H. Caso,: **Juvenility, rejuvenation and plant propagation in woody plants**. Agriscientia IX N° 1 : 5-16. 1992.

[19]. Poethig RS,:. **Phase change and the regulation of shoot morphogenesis in plants**. Science 250: 923-930.2002.

[20].Poethig S,: **Genetic regulation of vegetative phase change in plants**. Dev Biol 247(2): 521. 1990

[21] .Poethig RS,: **Phase change and the regulation of developmental timing in plants.** Science 301: 334-336.2003.

[22]. Poethig RS,:**The past, present, and future of vegetative phase change**. Plant Physiol 154: 541-544. 2010.

[23]. Rama.P : **Polaplasiasmos tis Elias Pikilias Kalamon** In Vitro PhD thessis,Athina 1989

[24]. Rama P, Pontikis C. A: **In vitro propagation of olive (Olea europea sativa. L) ’Klamon’. Jurnal of horticultural science** 1990, 65(3): 347

[25]. Rezq Basheer – Salimia.: **Juvenility, Maturity and Rejuvenation in Woody Plants.** Hebron University Research Journal, Vol (3), pp (17-43). 2007.

[26]. Rugini E. : **Prospettive di innovazione tecnologica per la propagazione e risanamento dell'olivo. La certificazione del materiale vivaistico: indirizzi per l'olivo.** Bari. 1997.

[27]. Rugini E., Politi V., Bignami C., De Agazio M., Grego S.: **Effect of polyamine treatments on rooting cutting of three olive cultivars**. Acta Hort., 286, 97-100. 1990.

[28]. Vakouftsis G, T. Syros, S. Kostas, A. S. Economou, P. Tsoulpha, A. Scaltsoyiannes, and D. Metaxas **Effect of IBA, time of cutting collection, type of cuttings and rooting substrate on vegetative propagation in Cupressus macrocarpa Goldcrest**. Propagation of Ornamental Plants 9: 65-70. 2009

[29]. Vieitez E, Vieitez A.: **SHS Acta Horticulturae 56: Symposium on Juvenility in Woody Perennials Juvenility factors related to the rootability of chestnut cuttings.** May 1976. J. A mer. Soc. Hort. Sci. 105(1):91-95. 1980.

[30.]. Wiesman Z., Lavee S.: **Enhancement of IBA stimulatory effect on rooting of olive cultivar stem cuttings.** Scientia Horticulturae, 62, 189-198. 1995a.

[31]. Wiesman Z., Lavee S.: **Relationship of carbohydrate sources and indole-3-butyric acid in olive cuttings**. Plant Physiology, 22, 811-816. 1995b