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EFFECT OF CYTOKININS AND AUXINS ON MICROPROPAGATION OF DATE PALM (*PHOENIX DACTYLIFERA* L.) SEWI CV. DURING THE MULTIPLICATION AND ROOTING STAGES

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ABSTRACT: *Micropropagation is an alternative and improving method established for propagation of date palm. The success of date palm micropropagation is strongly linked to the in vitro plantlets quality during multiplication and rooting. This study aimed to evaluate the effect of different types and concentrations of cytokinins (kinetin, 2iP and BA) only or with auxin (0.1 mg/l NAA) on the in vitro growth of formed secondary somatic embryos of Egyptian semi -dry date palm Sewi cv. resulted from maturation stage. Data obtained after 3 months have shown that using multiplication medium supplemented with 0.5 mg/l Kin + 0.5 mg/l 2iP + 0.1 mg/l NAA has achieved the highest significant value for secondary somatic embryos number, shoots length and growth value. Adding 0.5 mg/l BA + 0.5mg/l 2iP + 0.1 mg/l NAA to culture medium produced a highest significant value of shoots and roots number. The results clear that combination among cytokinins and auxin had active role in the multiplication stage. In rooting stage, adding 0.5 mg/l NAA + 1.0 mg/l IBA, without potassium silicate giving the highest significant value of rooting percentage, shoot length, leaves number and growth value. While using rooting medium supplemented with 0.5 mg/l potassium silicate without auxins recorded highest value of root length.*

Key words: *Microprpagation, date palm, multiplication stage, rooting stage, NAA, cytokinins.*

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is one of the oldest fruit crop mainly cultivated in North Africa, Middle East, Near East of Asia and some dispersed areas of Europe and America (Zaid, 2002; Hodel and Johnson, 2007 and Haider *et al.,* 2013). It is an out-crossed, perennial monocotyledon which is consequently very heterozygous. In addition to these features, date palm is dioecious, that is with separate male and female palms. Seedlings would therefore be approximately 50% male. Male and female seedlings are not identifiable until flowering. Only few male palms are required in the plantations as sources of pollen for fruit development. In order to obtain known female planting materials, offshoots could be taken from mother palms for planting. The limitations however, are that the average sucker production per palm per lifetime is low and restricted mainly to the juvenile years and the suckers are difficult to root. Some genotypes also do not produce suckers (Al-Khayri and Al-bahrany 2001). One more disadvantage of this method is the spread of dangerous diseases and pests such as Bayoud disease or Red Palm Weevil which can be transported by contaminated offshoots. To satisfy the increasing demand of healthy date palm plants for national and international markets, it necessary to develop alternative methods of vegetative propagation to produce large numbers of disease-free plants from selected genotypes. The use of tissue culture is the most suitable approach for large-scale plant propagation of such recalcitrant crop. High quality and uniform planting material can be multiplied on a year-round basis under disease-free conditions anywhere irrespective of the season and weather (Mujib *et al*., 2004 and Bhattacharjee, 2006). This technique also provides a rapid system for production of large number of genetically uniform and

disease free plantlets for agriculture and forestry (Aslam and Khan, 2009). In vitro development of callus and tissues depends on different factors such as genotypes, type of plant and external environment including composition of media and physical culture condition. El-Sharabasy (2000) studied the effect of different cytokinins concentration (BA, Kin or 2iP) on shoot formation of date palm Sewi cultivar. The highest number of shoot was formed on MS medium supplemented with 3.0 mg/l BA. Abd-El-Baky (2001) reported that for shoot multiplication of date palm the medium containing 3.0 mg/l 2iP was the best and gave many shoots after three subculturing. Taha *et al.,* (2001) cleared that shoot bud proliferation of date palm was enhanced on medium containing 3.0 mg/l 2iP + 0.5 mg/l NAA. However, the highest shoot length was observed on the hormone-free medium after 6 weeks of culturing. The number of shoot buds increased with increasing sucrose concentration up to 30 g/l. However, the highest shoot buds were observed with 40 g/l sucrose concentration. Abo El-Soaud *et al.,* (2002) and Zaid (2003) clarified that low concentrations of cytokinins and auxins encourage and enhance shoots production; while, high concentrations were not effective on shoots production and at the same time lead to producing weak growth shoots with formation of callus on the base of culture. Also, Gadalla (2003) noted that BA gave the highest value of leaves number/plantlet, and the best concentrations of cytokinin were 0.05, 0.1, or 0.2 mg/L. The number of plantlets was increased by using BA at concentrations 0.05, 0.1, 0.2 or 0.4 mg/L. In addition, plantlet length was increased by using BA at 0.05, 0.1, 0.2 or 0.4 mg/L. Rooting is an important in vitro stage of a micropropagation protocol of date palm. Zaid and Tisserat (1983) reported that the best rooting of date palm results were noticed on medium without charcoal with 0.1 mg/l NAA. Eke *et al.,* (2005) stated that the shoots of date palm produced roots when transferred to a medium, which contained NAA at 0.1 mg/l. Burasheed *et al.,* (2006) noted that the highest rooting percentage was obtained with half strength MS medium supplemented with IBA at 3.0 mg/l for Barhee date palm, while 3.0 or 5.0 mg/l produced the highest rooting percentage and root number/shoot for Khalas. The longest roots were obtained with IBA at 1.0 mg/l.

Regarding to Silicate, are compounds containing both Si and oxygen. Silicate refers to Si-containing crystalline or amorphous compounds such as calcium silicate (CaSiO3), magnesium silicate (MgSiO3), sodium silicate (Na2SiO3), or potassium silicate (K2SiO3). Heckman (2013) some observed that benefits due to Si nutrition include: Direct stimulation of plant growth and yield through more upright growth and plant rigidity. Alleviating various environmental stresses. Silicon is the second most abundant element after oxygen in soils and its presence in the form of silicic acid allows its uptake by plants, so by nature plants have a great scope to uptake Si in their tissues. However, those plants not supplied with sufficient natural sources of Si may benefit from its exogenous application (Hasanuzzaman *et al.,* 2014). Silicon, when readily available to plants, plays a large role in their growth, mineral nutrition, mechanical strength, resistance to fungal diseases, and adverse chemical conditions of the environment. Plants grown in conventional nutrient solutions are thus to an extent experimental artifacts. Omission of silicon from solution cultures may lead to distorted results in experiments on inorganic plant nutrition, growth and development, and responses to environmental stress (Epstein, 1994). A silicate fertilizer [$MgCa(SiO_3)_2$] was supplemented at 0, 40, 80, 120 or 160 g/l medium. Silicate fertilizer supplementation at 40 g/l medium resulted in the greatest plant height, leaf width and length, length of the longest root, and root fresh and dry weights in both kalanchoe and carnation (Bae *et al.,* 2010).

The aim of this work is to optimize shooting stage by using different cytokinin combinations (kinetin, 2iP and BA) only or plus 0.1 mg/l NAA added to multiplication nutrient medium also current study focused on the combined effect of auxin with

potassium silicate at the culture media during rooting stage in order to get rapid and satisfied adventitious rooting and subsequently increase the survival percentage of the acclimatized plants in the greenhouse.

MATERIALS AND METHODS

Establishment of explants material

This experimental work was performed at the Central Laboratory of Date Palm Researches and Development, Agricultural Research Central, Egypt. during the period from 2009 to 2013. Sterilized shoot apical meristems from offshoots of Sewi cv. were used as sources for initiation of callus cultures using MS basal medium (Murashige and Skoog 1962) contained 10 mg/l 2,4-D dichlorophenoxy acetic acid (2,4-D) + 3 mg/l 2- isopentenyl adenine (2iP) (Tisserat, 1984 and Zayed *et al.,* 2007). Cultures were incubated at day and night temperature of 27 ±2ºC under complete darkness for 24 weeks with sub culturing to fresh medium of the same composition every twelve weeks. The embryogenic callus was proliferated into somatic embryos by subculturing for at least four subcultures on MS basal medium supplemented with 200 mg /l glutamine + 170 mg / l NaH2PO4.

Embryos multiplication and development:

A small cluster containing 3 - 4 embryos were used as the explant materials in this stage. Cluster explants from Sewi cultivar were cultured on MS basal nutrient media solidified supplemented with different cytokinin combinations (kinetin, 2iP and BA) only or plus 0.1 mg/l NAA with 0.2 g/L activated charcoal to stimulate secondary somatic embryos formation and increase number of shoots as follow:

T_1: MS free hormone.
T_2: MS + (in mg/l) 0.25 BA + 0.25 kin. with or without 0.1 mg/l NAA.
T_3: MS + (in mg/l) 0.5 BA + 0.5 kin. with or without 0.1 mg/l NAA.
T_4: MS + (in mg/l) 0.25 BA + 0.252iP. with or without 0.1 mg/l NAA.
T_5: MS + (in mg/l) 0.5 BA + 0.5 2iP. with or without 0.1 mg/l NAA.
T_6: MS + (in mg/l) 0.25 2iP + 0.25 kin. with or without 0.1 mg/l NAA.
T_7: MS + (in mg/l) 0.5 2iP + 0.5 kin. with or without 0.1 mg/l NAA.

The individual treatment conducted three replicates, each contained 3 jars sized 150 ml and each jars contained one cluster. Whereas incubated in growth room at 27 ± 1ºC under 16 hrs daily exposure to low light intensity (1000 lux illumination). The explants were recultured 3 times every 4 weeks intervals into corresponded fresh medium. The following data were recorded after 3 months:

1. Number of secondary embryos.
2. Number of shoots.
3. Shoot length (cm).
4. Number of roots.
5. Growth vigor which recorded visually as the method described by Pottino (1981).

Rooting of developed shoots:

In this stage, an individual shoots 9-12 cm long derived from the previous stage of this experiment were used as plant materials. Shoot explants were cultured on media as follow:

M1: half MS free hormone and potassium silicate.
M_2: half MS + (in mg/L) 0.5 NAA + 1 IBA.
M_3: half MS + (in mg/L) 0.5 NAA + 1 IBA + 0.05 potassium silicate.
M_4: half MS + (in mg/L) 0.5 NAA + 1 IBA + 0.1 potassium silicate.
M_5: half MS + (in mg/L) 0.5 NAA + 1 IBA + 0.2 potassium silicate.
M_6: half MS + (in mg/L) 0.5 NAA + 1 IBA + 0.4 potassium silicate.
M_7: half MS + (in mg/L) 0.0 NAA + 0.0 IBA + 0.5 potassium silicate.

All culture media of each were added to half MS basal nutrient medium, which supplemented with 0.4 mg/L thiamine-HCl + 2.0 mg/L Glycine + 1 g/L activated charcoal + 30 g/L sucrose + 6 g/L agar to stimulate roots number initiation and shoots growth were distributed into culture tubes sized 25 x250 mm that contained 25 ml of the previous media and covered by Poly Propylene caps.

All culture tubes were incubated at 27±2°C for 3 months (through two recultures) in growth room under 16 hrs illuminations of 3000-4000 Lux white fluorescent lamps. After 6 and 12 weeks in culture, the following data were recorded.

1. Rooting percentage (%).
2. Root length (cm).
3. Shoot length (cm).
4. Number of leaves/shoot.
5. Growth vigor was recorded visually as the method described by Pottino (1981).

Statistical analysis:

Data obtained were subjected to the analysis of variances of randomized complete design as recommended by Snedecor and Cochran (1980). LSD at 5% level of significance was used to compare between means according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Embryos multiplication and development:

Experiment 1: Effect of different types and concentrations of cytokinins on multiplication.

Data presented in Table (1) and Figure (1) indicated that, number of secondary embryos, number of shoots, shoots length, number of roots, growth value after 3 months were affected by different media compositions (type of cytokinins at different concentration).Concerning to number of secondary embryos, the obtained data clearly showed that medium No. 7 (0.50 Kinetin + 0.50 2iP) was the most effective media composition to produce a highest significant value of secondary embryos number (24.67). The lowest value was noticed by using culture medium No. 1 (free hormone or control medium) as the results was 7.7 secondary embryos. Regarding with number of shoots, the highest significant value of shoots number was observed by adding 0.25 Kinetin mg/l + 0.25 2iP mg/l to culture medium (5 shoots), while the lowest value was noticed by using culture medium No. 1 (control) as the result was 1.2 shoots.

As regards shoots length (cm), using medium No. 6 gave highest significant value of shoot length (3.6 cm) compared with medium No. 1 (control medium) showed the lowest significant value of shoots length (1.3 cm). As for number of roots, medium No. 6 was the most effective media composition to produce a highest significant value of root number/explant (3.3), While the lowest value was observed by using culture medium No. 1 or medium No. 5 as the results were 0.56 or 0.67 root/explant. With respect to growth vigor, Data in this Table clearly show that medium No. 7 was the most effective media composition to produce a highest significant growth vigor of shoot multiplication (3.67 compared with control medium (medium No. 1) which the lowest significant value of growth vigor.

The results obtained in this experiment highlighted the importance of types and concentrations of cytokinins either effect on shoots multiplication. The present of different cytokinin combinations at different concentrations enhanced all parameters under investigation compared with control medium (medium free hormone. In date palm Calero *et al.,* (1990) reported that the presence of BA was necessary for the normal production of plantlets and 0.1 mg/L BA increased the normal produced. While, the presence of cytokinins in the medium may result in the formation of multiple apices in somatic embryo. In oil palm Merkle (1995) showed that the increase of the number of embryoids may be the consequence of the stimulation of multiple shoot formation by long-term culture on medium with cytokinin. Also, Gadalla (2003) showed that added BA to culture medium gave the highest value of leaves number/plantlet, number of plantlets, plantlet length and the best concentrations of cytokinin were 0.05, 0.1, or 0.2 mg/L.

On the other line, Zaid (2003) stated that addition of kinetin to MS medium enhanced shoot multiplication and shoot length compared with 0.5 mg/L 2iP.Whereas, addition of 2iP (cytokinin type) proved to be less effective than BA cytokinin type in inducing shoot proliferation (Abo El-Soaud *et al.,* 2002).

Table (1): Effect of different types and concentrations of cytokinins on shoots multiplication of date palm Sewi cv.

culture media	Cytokinins types and concentrations mg/l	Secondary embryos	Number of shoots	Shoots length	Number of roots	Growth vigor
M1	Control	7.7	1.2	1.3	0.56	1.1 c
M2	0.25 BA+ 0.25 Kin	9	2.67	1.8	1.67	2.67
M3	0.50 BA+ 0.50 Kin	16.67	3.67	2.5	2.3	2.3
M4	0.25 BA+0.25 2iP	11	3	1.9	1	3
M5	0.50 BA +0.50 2iP	22	1.67	1.5	0.67	2.3
M6	0.25 Kin+0.25 2iP	12	5	3.6	3.3	3
M7	0.50 Kin+0.50 2iP	24.67	3.3	2.0	2	3.67
LSD at 0.05		1.809	1.229	0.582	1.197	1.102

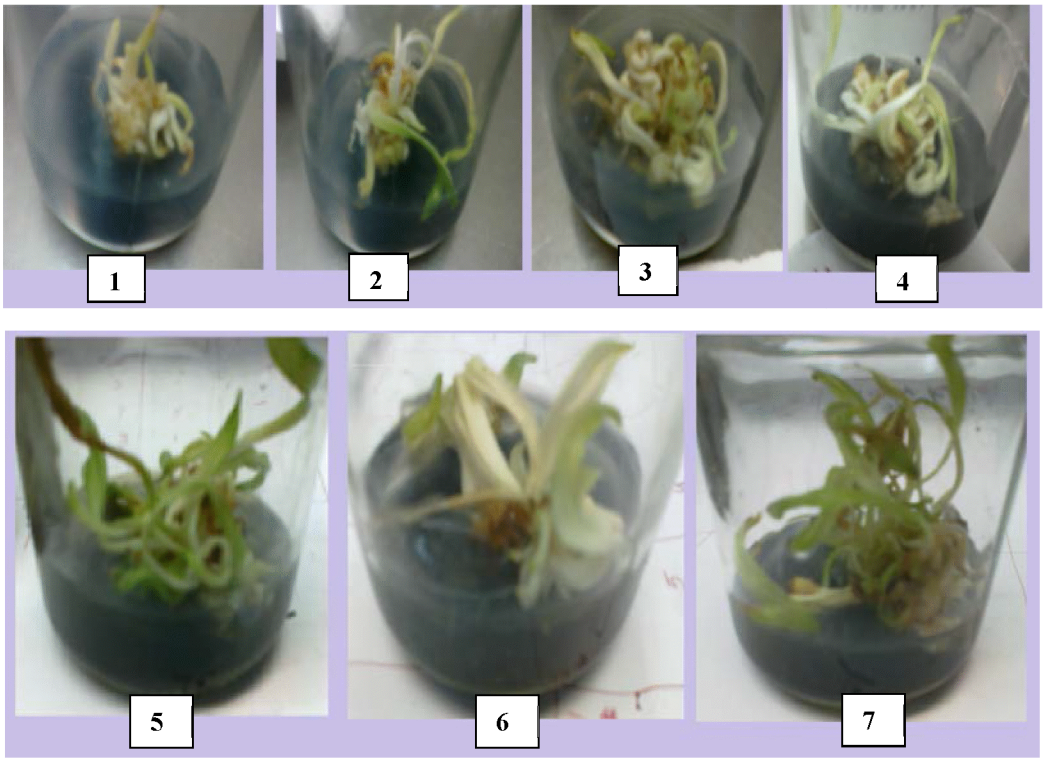

Fig. 1. Effect of different types and concentrations of cytokinins on multiplication.

1- Control. 2- 0.25 mg/l BA+ 0.25 mg/l Kin. 3- 0.50 mg/l BA+ 0.50 mg/l Kin.
4- 0.25 mg/l BA+0.25 mg/l 2iP. 5- 0.50 mg/l BA +0.50 mg/l 2iP. 6- 0.25 mg/l Kin+0.25 mg/l 2iP.
7- 0.50 mg/l Kin+0.50 mg/l 2iP.

Experiment 2: Effect of different types and concentrations of cytokinins with (NAA) auxin on multiplication.

Data presented in Table (2) And Figure (2) indicate that Number of secondary embryos, number of shoots, shoots length, number of roots, growth vigor after twelve weeks was affected by different media compositions (type of cytokinin at different concentration and auxin).

As for Number of secondary embryos, medium No. 7 (0.50 mg/l Kinetin + 0.50mg/l 2iP + 0.1mg/l NAA) was the most effective media composition to produce a highest significant value of secondary embryos number (33.67). While the lowest value was noticed by using culture medium No. 1 (free hormone or control medium) as the result was 9 secondary embryos. Regarding with number of shoots, data in this Table showed that the highest significant value of shoots number was observed by adding 0.5mg/l BA + 0.5mg/l 2iP+ 0.1 mg/l NAA to culture medium (11.67 shoots), whereas the lowest significant value was noticed by using culture medium No. 1 (medium without any cytokinins or auxin) as the results was 0.95 shoots. Concerning to Shoots longth, using medium No. 7 gave the highest significant value of shoot length (3.7 cm), whilst the lowest significant value was noticed by using culture medium No. 1 (control medium) as the results was 1.1 cm. Regarding number of roots, medium No. 5 was the most effective media composition to produce a highest significant value of root number/explant (4.0). However the lowest significant value was observed by using culture medium No. 1 as the results was 0.50 root/explant.

With respect to growth vigor, medium No. 7 was the most effective media composition to produce highest significant growth vigor of shoot multiplication (4.0). Whereas the lowest significant value was observed by using culture control medium without adding any concentration of cytokinin and auxin (medium No. 1) as the result was 1.2.

Table (2): Effect of different types and concentrations of cytokinins and auxin on multiplication of date palm Sewi cv.

culture media	Cytokinins types and concentrations mg/l	Auxin mg/l	No. of Secon. embryos	No. of shoots	Shoots length (cm)	No. of roots	Growth vigor
M1	Control		9	0.95	1.1	0.5	1.2
M2	0.25 BA + 0.25 Kin	0.1 NAA	12	4	1.3	1	3
M3	0.50 BA + 0.50 Kin	0.1 NAA	19	2	1.9	2	3.67
M4	0.25 BA + 0.25 2iP	0.1 NAA	23.67	2	1.4	1	2
M5	0.50 BA + 0.50 2iP	0.1 NAA	30	11.67	2.2	4	3.67
M6	0.25 Kin + 0.25 2iP	0.1 NAA	14	3.67	1.9	1.3	3.3
M7	0.50 Kin + 0.50 2iP	0.1 NAA	33.67	9.3	3.7	2.3	4
LSD at 0.05			1.927	1.747	0.542	1.032	0.790

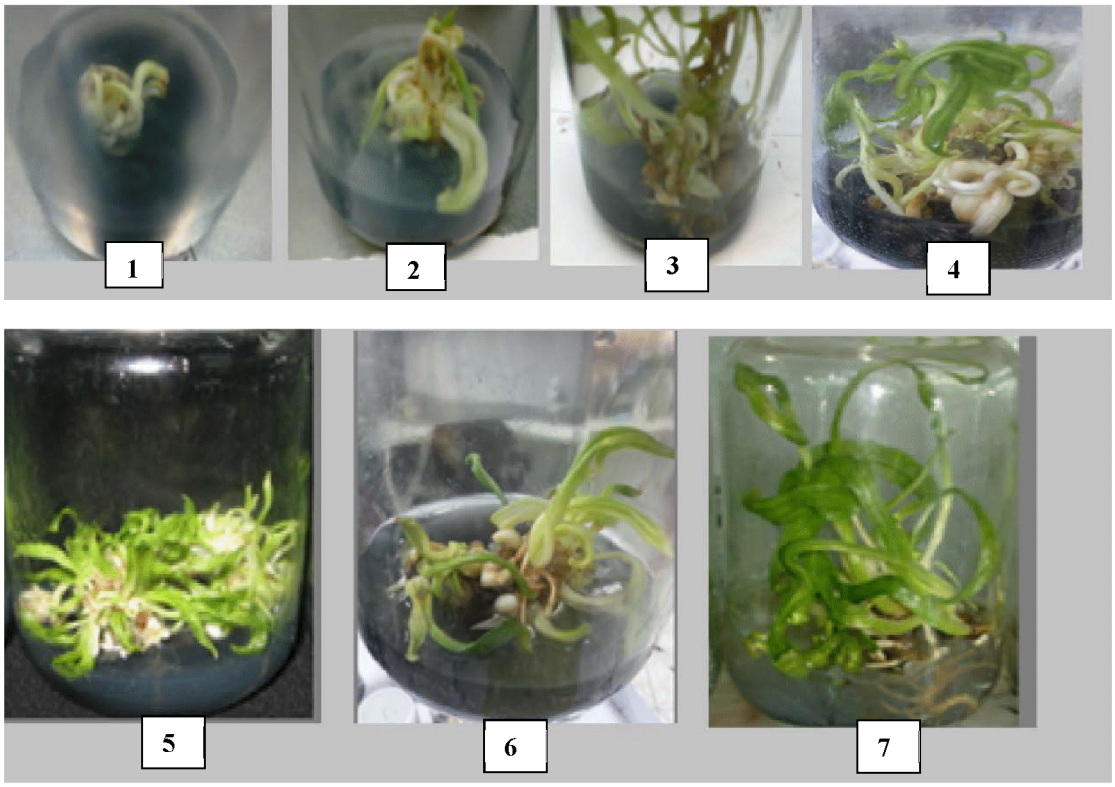

Fig. 2. Effect of different types and concentrations of cytokinins with with 0.1 mg/l NAA (auxin) on multiplication. All concentrations (mg/l)

1- Control. 2- 0.25 BA+ 0.25 Kin + 0.1 NAA. 3- 0.50 BA+0.50 Kin+ 0.1 NAA.
4- 0.25 BA+0.25 2iP + 0.1 NAA. 5- 0.50 BA +0.50 2iP + 0.1 NAA. 6- 0.25 Kin+0.25 2iP + 0.1 NAA.
7- 0.50 Kin+0.50 2iP + 0.1 NAA.

The results in this Table lead to a conclusion that using medium supplemented with 0.5 mg/l Kin + 0.50 mg/l 2iP + 0.1 mg/l NAA and medium supplemented with 0.5 mg/l BA + 0.5mg/l 2iP + 0.1 mg/l NAA were the best media for shoot multiplication. It could be emphasized that type and concentration of cytokinins and auxin on either the role of shoots multiplication. These results are in accordance with Abo El-Soaud *et al.,* (2002); Gadalla (2003) and Zaid (2003) who suggested that low concentrations of cytokinins and auxins encourage and enhance shoots production; while, high concentrations were not effective on shoots production and at the same time lead to producing weak growth shoots with formation of callus on the base of culture. Belal *et al*., (1993) used MS medium containing high cytokinins concentration and low auxin concentration for shoot proliferation in date palm cvs. (Zaghloul and Samani).

Saker *et al.,* (1998) mentioned that shoot proliferation after a phase of callus formation was confined to culture medium containing 3.0 mg/l 2iP + 0.1 mg/l NAA + 3.0 g/l AC. 2iP was more effective than either kinetin or BA in shoot proliferation of date palm.

Rooting of developed shoots:

Experiment 3: Effect of auxin and potassium silicate on rooting of date palm Sewi cv. recorded after 3 months.

As shown in Table (3) and Figure (3) rooting percentage, root length (cm), shoot length (cm), leaves number and growth value of plantlet after 3 months was affected significantly by type of media (auxin and potassium silicate).

Table (3): Effect of auxin and potassium silicate on rooting of date palm Sewi cv. recorded after 3 months.

culture media	auxin (mg/l)		potassium silicate k_2sio_3 (mg/l)	Rooting percentage (%)	Root length (cm)	Shoot length (cm)	Leaves number	Growth vigor
	NAA	IBA						
M1	0.5	1.0	0.0	100	3.67	24	5	4
M2	0.5	1.0	0.05	91.33	3.3	22.3	2.67	3.67
M3	0.5	1.0	0.1	85.56	2	21	2.3	3.3
M4	0.5	1.0	0.2	81.33	3.67	25	3.3	3
M5	0.5	1.0	0.4	72.67	2.3	19.67	1.67	2.67
M6	0.0	0.0	0.5	91.33	4.3	21.3	2.67	3.67
LSD at 0.05				5.990	1.032	1.510	1.272	0.857

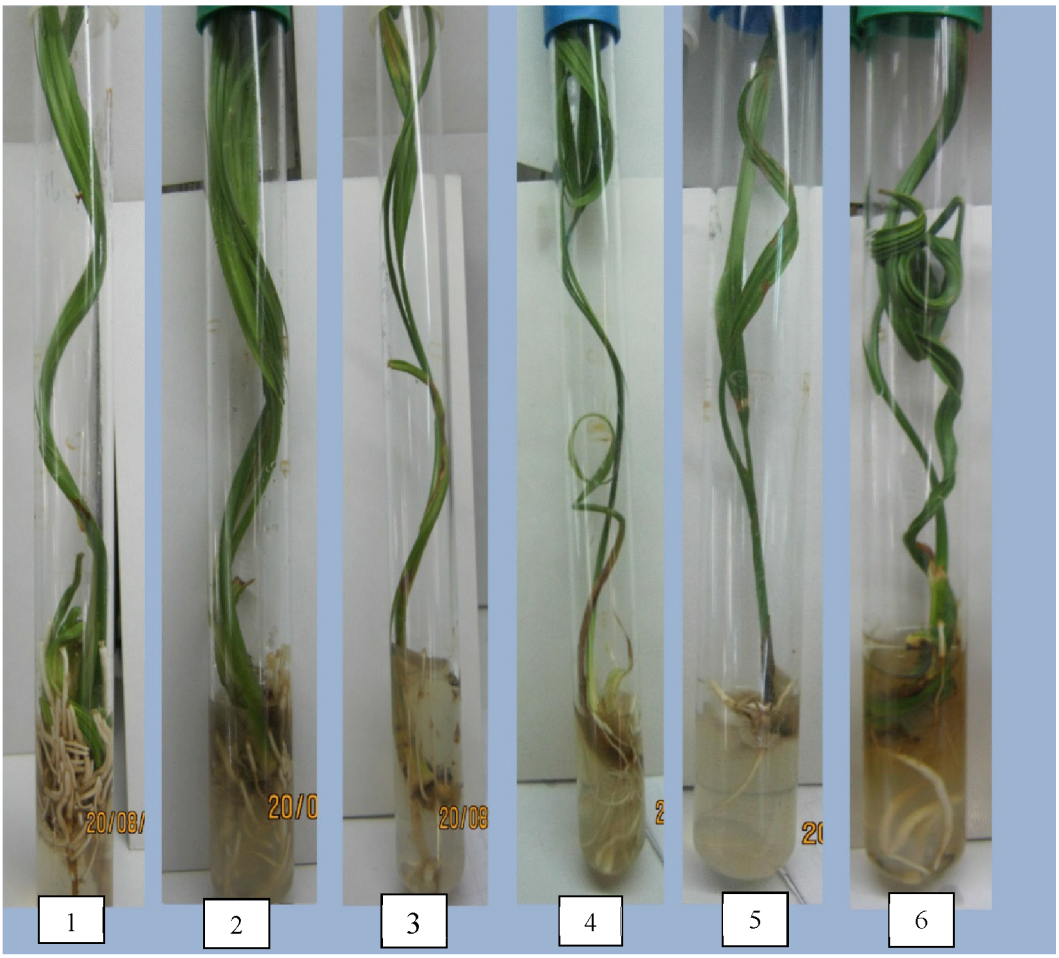

Fig. 3. Effect of auxin and potassium silicate on rooting of date palm Sewi cv. recorded after 3 months. All concentrations (mg/l)

1- 0.5 NAA + 1.0 IBA. 2- 0.5 NAA+ 1.0 IBA + 0.05 3- 0.5 NAA+1.0 IBA + 0.1 k_2sio_3

4- 0.5 NAA+1.0 IBA + 0.2 k_2sio_3 5- 0.5 NAA + 1.0 IBA + 0.4 k_2sio_3 6- 0.5 k_2sio_3

Concerning to rooting percentage (%), shoots of palm cultured on medium contained NAA at 0.5 mg/l + IBA at 1.0 mg/l (medium No. 1) showed the highest significant rooting percentage (100%). Whilst the lowest value of rooting percentage was observed with medium supplemented at 0.5 mg/l NAA + 1.0 mg/l IBA + 0.4mg/l k_2sio_3 (medium No. 5) (72.67%). As for Root length (cm), Shoots of palm cultured on medium No. 6 developed the highest root length (4.3 cm) comparing with the other media. While the lowest significant values were observed by using medium No. 3 and medium No. 5 as the values were 2.0 and 2.3 (cm), respectively, with no significant difference inbetween. As regards shoot length (cm), data show that the highest significant values of shoot length (cm) were observed on medium No. 4 and medium No. 1 as the values were 25 and 24 cm, respectively without significant difference inbetween. However medium No. 5 produced the lowest significant value of shoot length (19.67cm). With respect to number of leaves/shoot, the highest significant value of leaves number was recorded on medium No. 1as the value was 5 leaves/shoot, compared with medium No. 5 (0.5 NAA + 1 IBA + 0.2 K_2Sio_3 (in mg/l)) which showed the lowest significant value of leaves number 1.67 leaves/shoot. Regarding to growth vigor, the highest significant value of growth vigor was observed on medium of adding 0.5 mg/l NAA + 1.0 mg/l IBA (medium free of K_2Sio_3) as the value was (4) comparing with the medium contained 0.5 mg/l K_2Sio_3 (medium free of auxin) which gave the value (3.67), with no significant difference inbetween. While the lowest significant value of growth vigor was observed on medium No. 5 as the value was (2.67).

The results in this Table lead to a conclusion that using medium supplemented with 0.5 mg/l NAA + 1.0 mg/l IBA gave the best rooting formation percentage, root number, shoot length (cm), leaves number and growth vigor. Such data indicate that the importance of types and concentration auxin on root formation of shoot. Neto *et al.,* (2003) in annatto *(Bixa orellana)* indicated that frequency of root induction of plantlets was dependent on IBA where using medium containing 5.0 µM IBA gave a higher number of adventitious roots. Anjarne and Zaid (1993) observed that high auxin concentrations, especially NAA, promoted root initiation of date palm Bouskri cv. El-Deeb and Sourour (2002) cultured in vitro shoots of Zaghloul date palm on MS medium containing different auxins (NAA, IAA and IBA) at 0.2, 0.4, 0.6 and 0.8 mg/l and they found that, NAA and IBA succeeded to produce a relatively large shoot length, number of leaves and root length and number, especially at lower concentrations (0.2 and 0.4 mg/l).

Our results observed that the highest root length was observed with media enriched with K2SiO3 in this line Heckman (2013) reported that Si plays an important role in plant health. One major contribution of Si is reinforcement of cell walls by deposition of solid silica. Optimization of silicon nutrition results in increased mass and volume of roots, giving increased total and adsorbing surfaces (Matichenkov, 1996). Silicon fertilizer increases root respiration (Yamaguchi *et al.,* 1995). A germination experiment with citrus (Citrus spp.) has demonstrated that with increasing monosilicic acid concentration in irrigation water, the weight of roots increased more than that of shoots (Matichenkov *et al.,* 1999). The same effect was observed for bahia grass (*Paspalum notatum* Flügge) (Matichenkov *et al.,* 2000).

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تأثير السيتوكينينات والأوكسينات علي الإكثار الدقيق لنخيل البلح صنف السيوي خلال مرحلتي التضاعف والتجذير.

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الملخص العربى

يستخدم الاكثار الدقيق كطريقة مختلفة ومتطورة لأكثار نخيل البلح معمليا. نجاح الإكثار الدقيق لنخيل البلح في المختبر يتوقف علي جودة النبيتات خلال مرحلتي التضاعف والتجذير. أجرى هذا البحث لتقييم تأثير انواع وتركيزات مختلفة من السيتوكينينات (ايزوبنتنيل ادنين و بنزيل ادنين وكينتين) فقط او في وجود الأوكسين (٠.١ ملجم/لتر نفثالين حامض الخليك) على نمو و تضاعف الأجنة الجسدية الثانوية للصنف السيوي النصف جاف المتكونة في مرحلة النضوج. أوضحت النتائج بعد ٣ أشهر من الزراعة أن استخدام بيئة التضاعف المحتوى على ٠.٥ملليجرام/لتر كينتين+٠.٥ملليجرام/لتر ايزو بنتيل ادينين + ٠.١ملليجرام/لتر نفثالين حمض الخليك حقق أعلي عدد لتكوين الاجنة الثانوية وأعلي طول معنوي للافرع وافضل قوة نمو. أدى إضافة ٠.٥ ملجم/لتر من البنزيل ادنين وايزوبنتينيل ادينين + ٠.١ مجم/لتر نفثالين حمض الخليك لبيئة الزراعة الي أكبر عدد لتكوين الافرع والجذور. يتضح من هذه النتائج ان الجمع بين أوكسين والسيتوكينينات لهما دور فعال في مرحلة التضاعف. وفي مرحلة التجذير وجد ان إضافة ٠.٥ملجم/لتر نفثالين حمض الخليك + ١مجم/لتر اندول حمض البيوتريك وبدون سليكات البوتاسيوم أعطي أعلي نسبة مئوية للتجذير واعلي طول معنوي للافرع واكبر عدد من الاوراق وافضل قوة نمو بينما بيئة التجذير المحتوية علي سيليكات البوتاسيوم بتركيز ٠.٥ ملجم/لتر وبدون اوكسين حققت أعلي فرق معنوي لطول الجذور.