

EFFECT OF SOME CHEMICAL MUTAGENS ON MORPHOLOGICAL CHARACTERS AND CORM PRODUCTIVITY OF SOME *GLADIOLUS SP.* CULTIVARS

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ABSTRACT: Two pot experiments were carried out at the Nursery of Antoniadis Botanical Garden, Hort. Res. Inst., Alexandria, Egypt during the years of 2012 and 2013. The objectives of this study were to study the effect of soaking corms of three cultivars of *Gladiolus sp.*, namely: Eurovision (Red), Nova Lux (Yellow) and Peter Pears (Peach) in the aqueous solution of either ethyl methane sulfonate (EMS) at the rates of 0, 0.1, 0.2, 0.3 and 0.4 % concentrations for 24 hrs. or colchicine at the rates of 0 and 0.1% concentrations for 24 or 48 hrs. on growth performance and corm production.

The obtained results indicated that the different levels of EMS had a slight effect on sprouting date, but colchicine treatments induced a significant earliness in both seasons, with the dominance of soaking for 24 hrs. treatment. Cultivar factor had no pronounced effect on sprouting date. All treatments increased plant height over control, but the tallest plants were obtained from corms soaked in EMS at 0.1 or 0.2% concentrations. Plants of cv. Peter Pears were generally taller than those of Eurovision and Nova Lux cultivars. The greatest No. leaves/plant were recorded in the two seasons by soaking the corms in 0.1% colchicine solution for 24 hrs. Furthermore, soaking in 0.1% colchicine solution for 48 hrs. and in EMS one up to 0.3% level recorded also a higher No. leaves. Eurovision and Nova Lux cvs. gave higher No. Leaves than cv. Peter Pears in both seasons. However, the greatest No. Leaves/plant for the 3 used cultivars in both seasons were also attributed to treating with 0.1% colchicine solution for 24 hrs. Colchicine at 0.1% for 24 hrs. resulted the widest diameter and heaviest fresh weight of the new formed corms, as well as the highest number of cormels/plant over control and other treatments in most cases of the two seasons. The highest No. cormels/plant in the two seasons were recorded for Eurovision and Nova Lux cvs. also by soaking in 0.1% colchicine solution for 24 hrs., but for cv. Peter Pears that was gained by soaking in 0.1% EMS solution for 24 hrs.

Therefore the study recommended to soak the corms of the three studied cultivars in 0.1% colchicine solution for 24 hrs. immediately before planting to get better growth performance and higher corm production.

Key words: Gladiolus - Ethyl methane sulfonate (EMS) - colchicine - corm production.



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INTRODUCTION

Gladiolus sp. L., corn flag or sword lily (Fam. Iridaceae) is one of the most important commercial cut flowers all over the world.

Chemical mutagens are used for induction mutations, as they usually give excellent and secure results. Ethyl methane sulfonate (EMS) is an organic compound. It is a mutagenic, teratogenic, and possibly carcinogenic. It produces random mutations in genetic material by nucleotide substitution; particularly by guanine alkylation. This typically produces only point mutations (Wikipedia, 2013).

In this regard, Misra and Bajpai (1983) on 9 cultivars of gladiolus, found that treating corms with Ethyl methane sulfonate (EMS), diethyl sulfonate (DES) or methyl nitroso urea (MNU) decreased corm production in some cultivars compared to the control, but increased it in other ones. On Gerbera, Schiva *et al.* (1984) revealed that using EMS at low concentration (0.1%) and for short time recovered large M2 population with a good rate of non-lethal mutations. Besides, Berenschot *et al.* (2008) mentioned that EMS at the rates of 0.05, 0.1, 0.15, 0.2 and 0.25 % caused developmental defects and decreased seedling viability in petunia plants obtained from the mutagenized seeds. High doses of EMS reduced the number of plants with primary leaves at 15 days after sowing by about 44% and decreased survival rate to 28% comparing with control. Similar observations were obtained by kannan *et al.* (2002) on *Jasminum sambac*, Latado *et al.* (2004) and Padmadevi and Jawaharlal (2011) on chrysanthemums, Dhakshana *et al.* (2010) on *Jatropha curcas* Yi and Traore (2011) who reported that exposure leaf sections of *Saintpaulia* cv. Crystopal to EMS at the rate of 0.2 , 0.4 and 0.6% for 30,60,120 or 240 minutes recovered adventitious shoots from the treated explants. Shoots producing at least 6 leaves were induced to root and the resulted plantlets were successfully transplanted to the soil.

Colchicine is a highly poisonous alkaloid, originally extracted from plants of genus colchicum, especially *C. autumnale* (also known as the Meadow saffron) and from corms of *Gloriosa spp.* It has a medicinal use to treat rheumatic complaints, especially gout. It was also used for inducing polyploidy in plant cells by inhibiting chromosome segregation during meiosis (Wikipedia, 2014). Subjecting the plants to various concentrations of colchicine for different durations exhibited a marked fluctuation in the morphogenetic characters. In this concern, El-Meligy (1981) declared that soaking corms of gladiolus cv. Eurovision in colchicine solution (200 ppm) for 6 hours increased the number and weight of cormels. Endo *et al.* (1997) observed that treated shoot tips of chrysanthemum with colchicine at the rate of 0.2% for either 24 or 48 hrs. resulted doubled chromosome plants which were obviously dwarfed with less number of branches, leaves and flower buds. On Asiatic hybrid lily "Connecticut king", Han *et al.* (1999) pointed out that increasing level and duration of colchicine treatment decreased survival rate and shoot regeneration.

On the same trend, Silva *et al.* (2000) on the proto corm-like bodies of *Cattleya intermedia*, Youssef (2003) on *Yucca elephantips* and *philodendron scandens*, Sayed *et al.* (2007) on *Solidago altissima* var. "Tara", Wu *et al.* (2007) on Oriental liliium cultivars "Con. Amore" and "Acapulco" and Xing *et al.* (2011) who noted that subjecting seeds of *Catharanthus roseus* to 0.2% colchicine solution for 24hrs. gave the highest percent of tetraploid plants which had larger stoma and more branches and leaves comparing with the control. Wang and Lei (2012) claimed that immature embryos of *Clivia miniata* treated with 0.01 or 0.03% colchicine gave tetraploids had thicker, wider, shorter, rougher and deeper-colorful leaves, fewer roots and slower growth than diploids.

This work aimed to study the effect of both EMS and colchicine at different

concentrations on morphological and corm production in some gladiolus commercial cultivars (Eurovision (Red), Nova Lux (Yellow) and Peter Pears (Peach)).

MATERIALS AND METHODS

Two pot experiments were consummated at the Nursery of Antoniadis Botanical Garden, Hort. Res. Inst., Alexandria, Egypt during the two consecutive seasons of 2012 and 2013 to explore the effect of both Ethyl methane sulfonate (EMS) and colchicine at various levels and soaking duration on vegetative growth and corm production of three cultivars of gladiolus.

Therefore, corms of three cultivars of *Gladiolus sp.*, namely: Eurovision (Red), Nova Lux (Yellow) and Peter Pears (Peach) at the size and weight ranged between 4-6 cm diameter and 40-50g, respectively for the three cultivars. The corms were dipped before planting in a fungicide solution of 0.25% orthocide for 20 minutes, and soaked in an aqueous solution of one of the following chemical mutagens:

- 1- Ethyl methane sulfonate (EMS), a commercial product of methane sulfonic acid ethyl (obtained from El-Gomhoria Co., Alex. branch) at the rates of 0.1, 0.2, 0.3, 0.4 % for 24 hours.
- 2- Colchicine, an alkaloid product (obtained from El-Gomhoria Co., Alex branch) at the rates of 0.1% for either 24 or 48 hours.
- 3- Corms of control treatment were soaked in tap water for 24 hours.

Immediately after soaking, the treated corms were planted on 15th of October for each season in 20-cm-diameter clay pots filled with about 2.5 kg of mixture of clay and sand (3:1, v/v) at a depth of 5 cm from soil surface (one corm/pot).

The experiments were set out in a complete randomized block design (Mead *et al.*, 1993) with factorial concept, as each treatment was replicated three times. Each replicate contained 5 corms. Irrigation and agriculture practices were done whenever

needed. The fertilization, however was carried out after one month from planting and repeated again one month later with the rate of 3g/pot of kristalon fertilizer (19:19:19 + micronutrients, manufactured by DSM Agrospecialists, Holland) as a soil drench.

Data recorded:

The mean number of days from planting to sprouting (days), plant height (cm) from the soil surface to the terminal top of plant and the mean number of leaves/plant were recorded before flowering. After flowering, however the new corm and cormels were lifted and cleaned to measure the following: new corm diameter (cm) and its fresh weight (g), as well as the average number of cormels/plant.

Data were then tabulated and statistically analyzed according to SAS Institute Program (1994) using Duncan's multiple range test (Duncan, 1955) to verify the significant difference between means of various treatments.

RESULTS AND DISCUSSION

Effect of some chemical mutagens and some *Gladiolus sp.* cultivars on:

1- Vegetative growth:

Data averaged in Table (1) revealed that the different levels of EMS had a slight effect on sprouting date of gladiolus corms with non-significant differences as compared to control in the two seasons, except for the concentration of 0.2% which caused a significant precocity in this character in the second season only. Concerning the effect of colchicine treatments, a significant earliness was obtained in both seasons. Soaking the corms in colchicine for 24hrs. recorded the least number of days from planting to sprouting in the two seasons (13.55 and 13.53 days against 15.14 and 15.82 days for control in the first and second seasons, respectively). Cultivar factor had no effect on such character in both seasons. However, the least number of days from planting to sprouting was attained by 0.1% colchicine treatment for 24hrs. with cv. Nova Lux in the

Table 1. Effect of some chemical mutagens on number of days from planting to sprouting, plant height and number of leaves/plant of some *Gladiolus sp.* cultivars during 2012 and 2013 years.

Chemical mutagen treatments	Cultivars				Plant height (cm)				No. leaves/plant			
	Eurovision	Nova Lux	Peter Pears	Mean	Eurovision	Nova Lux	Peter Pears	Mean	Eurovision	Nova Lux	Peter Pears	Mean
First year: 2012												
Control	13.33c	15.66ab	16.42a	15.14a	64.57d	57.70f	58.10f	60.12d	7.33ba	7.33ba	6.67b	7.11b
EMS at 0.1%	15.67ab	15.00b	16.33a	15.67a	78.60a	75.86ab	76.66ab	77.04a	8.00a	8.00a	6.67b	7.56ab
EMS at 0.2%	15.73ab	15.00b	13.67c	14.80ab	67.80bc	61.67e	70.16b	66.54c	8.00a	8.00a	7.33ba	7.78a
EMS at 0.3%	15.88ab	13.67c	14.70b	14.75ab	69.00b	69.50b	70.33b	69.61b	8.00a	8.00a	6.67b	7.56ab
EMS at 0.4%	14.50bc	13.66c	15.67ab	14.61ab	63.21de	63.53de	66.67c	64.47cd	7.66ab	6.67b	6.67b	7.00b
Colchicine at 0.1%(24hrs)	13.65c	13.33c	13.66c	13.55b	62.65ed	67.90bc	67.88bc	66.14c	8.00a	8.00a	8.00a	8.00a
Colchicine at 0.1%(48hrs)	13.67c	14.66b	13.66c	14.00b	61.33e	57.81f	62.50ed	60.55d	8.00a	8.00a	7.00ba	7.67a
Mean	14.53a	14.43a	14.87a	14.00b	66.74ab	64.85b	67.47a	66.14c	7.86a	7.86a	7.00b	7.67a
Second year: 2013												
Control	14.36bc	16.33a	16.78a	15.82a	59.41d	54.36e	59.40d	57.72d	7.33ba	7.33ba	6.66b	7.11b
EMS at 0.1%	16.50a	15.67ab	16.50a	16.22a	65.30bc	69.00ab	70.54a	68.28a	8.00a	8.00a	6.67b	7.56ab
EMS at 0.2%	14.10cb	15.52ab	13.46dc	14.36b	66.78b	70.03a	70.33a	69.05a	8.00a	8.00a	7.33ba	7.78a
EMS at 0.3%	16.90a	14.00c	15.00b	15.30ab	62.64c	63.48c	64.41cb	63.51b	8.00a	8.00a	6.67b	7.56ab
EMS at 0.4%	15.67ab	15.33ba	16.17a	15.72a	58.15de	55.00e	60.72d	57.96d	7.33ba	6.67b	6.67b	6.89b
Colchicine at 0.1%(24hrs)	13.81cd	13.67cd	13.10d	13.53c	65.50bc	66.89b	71.00a	67.80ab	8.00a	8.00a	8.00a	8.00a
Colchicine at 0.1%(48hrs)	14.28bc	15.00b	14.00c	14.43b	58.00de	60.33d	61.38cd	59.90c	8.00a	8.00a	6.90b	7.63a
Mean	15.09a	15.08a	15.00a	14.43b	62.25b	62.73b	65.40a	62.25b	7.81a	7.72a	6.99b	7.63a

* EMS: Ethyl methane sulfonate.

* Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5 % confidence level.

1st season (13.33 days) and with cv. Peter Pears in the 2nd one (13.10 days).

As for plant height (cm), data in Table (1) showed that all treatments increased this parameter over control with various significance levels in the two seasons, but the tallest plants were obtained from corms soaked in EMS at 0.1% concentration in the first season and those soaked in EMS at either 0.1 or 0.2% concentration in the second one. Concerning the effect of cultivars, cv. Peter Pears plants were taller than those of the other two cultivars in the two seasons. Results of interactions indicated that the tallest plants in the first season were scored by cv. Eurovision corms treated with 0.1% EMS solution (78.6 cm) and followed by corms of Peter Pears and Nova Lux cultivars treated with the same treatment, while in the second one, that was attained by Peter Pears cultivar corms subjected to colchicine at 0.1% for 24 hours and followed by plants of the same cultivar (Peter Pears) resulted from corms soaked in EMS solution at either 0.1 or 0.2% concentrations. Corms of Nova Lux cultivar treated with 0.2% EMS solution also gave a height closely near to those of the previous treatments in the second season.

The greatest number of leaves/plant (as shown in Table, 1) was obtained in the two seasons by soaking corms in 0.1% colchicine solution for 24 hours (8 leaves/plant in both seasons). Colchicine at 0.1% for 48 hours and EMS up to 0.3% concentration treatments registered also a higher number of leaves, but it was to some extent lesser than that of soaking in colchicine for 24 hours treatment. Cultivars of Eurovision and Nova Lux gave higher number of leaves than cv. Peter Pears in the two seasons. However, the highest number of leaves/plant for the three studied cultivars was ascribed to treating with 0.1% colchicine for 24 hours in the two seasons. A similar trend was also recorded by EMS at 0.1, 0.2 and 0.3 levels, as well as colchicine for 48 hours in both seasons.

Reduction of growth, especially at higher concentrations or soaking for long

duration may be attributed to the high toxicity of the used mutagens and its direct role on depression the biosynthesis of some amino acids, such as L-cysteine and O-acetyl serine in the meristematic cells (Inter Net site 1, 2000), whereas increasing mean number of branches or leaves may refer to the ability of these mutagens to overcome the apical dominance and hence, stimulate the lateral buds to develop into new leafy shoots (Vainola, 2000). These findings however are in accordance with those observed by Endo *et al.* (1997) on chrysanthemum, Han *et al.* (1999) on liliun, Berenschat *et al.* (2008) on petunia, Xing *et al.* (2011) on *Catharanthus roseus* and Wand and Lei (2012) on *Clivia miniata*.

2- Corm production:

Data presented in Table (2) exhibit that colchicine at 0.1% for 24 hours. resulted the widest diameter (cm) and heaviest fresh weight (g) of the new corms, as well as the highest number of cormels/plant comparing with control and other treatments in the two seasons, except for EMS treatment at 0.1% concentration which gave number of cormels in the first season closely near to that of the previous best treatment. Concerning the effect of cultivars, Peter Pears cultivar gave the largest diameter in both seasons in comparison to Eurovision and Nova Lux cultivars. Whereas cv. Eurovision registered heavier fresh weight and higher number of cormels than the other two cultivars in both seasons. Regarding the interaction treatments, it could be noticed that colchicine solution at 0.1% for 24 hours was the best treatment for getting the best diameter and fresh weight of the new formed corms in the three studied cultivars, while the highest number of cormels/plant in the two seasons was scored for Eurovision and Nova Lux cvs. by soaking the corms in 0.1% colchicine solution for 24 hours, but for Peter Pears cultivar that was gained by soaking in EMS solution at 0.1% level.

These results could be interpreted and discussed as done before in case of vegetative growth characters.

Table 2. Effect of some chemical mutagens on new corm diameter, fresh weight and number of cormels of some *Gladiolus sp.* cultivars during 2012 and 2013 years.

Chemical mutagen treatments	New corm diameter (cm)				New corm fresh weight (g)				No. cormels / plant			
	Eurovision	Nova Lux	Peter Pears	Mean	Eurovision	Nova Lux	Peter Pears	Mean	Eurovision	Nova Lux	Peter Pears	Mean
	First year: 2012											
Control	3.20 bc	3.03 c	3.80 ab	3.34 c	29.50 bc	21.53 e	23.02 de	24.68 cd	29.21 d	19.60 g	13.70 ih	20.84 c
EMS at 0.1%	3.33 b	3.41 b	3.87 ab	3.54 b	30.00 b	29.57 bc	28.69 cb	29.42 b	37.80 b	27.33 de	34.62 bc	33.25 a
EMS at 0.2%	3.56 ba	3.00 c	3.67 b	3.41 bc	34.37 a	26.50 cd	25.67 dc	28.85 b	30.00 d	25.40 e	19.50 g	24.97 b
EMS at 0.3%	3.28 b	3.03 c	3.50 ba	3.27 c	30.33 b	24.18 d	25.00 d	26.50 c	29.40 d	14.58 hi	16.31 h	20.10 c
EMS at 0.4%	3.25 b	3.24 b	3.56 ba	3.35 c	21.94 e	23.07 de	24.12 d	23.04 d	20.76 g	10.36 i	14.50 hi	15.21 d
Colchicine at 0.1%(24hrs)	4.43 a	4.29 a	4.33 a	4.35 a	34.98 a	32.76 ab	32.36 ab	33.37 a	46.63 a	33.70 c	22.80 f	34.38 a
Colchicine at 0.1%(48hrs)	3.35 b	3.10 cb	3.69 b	3.38 cb	30.37 b	27.31 c	24.15 d	27.28 bc	35.70 b	11.42 i	20.33 g	22.48 bc
Mean	3.49 ab	3.30 b	3.78 a		30.21 a	26.42 b	26.14 b		32.80 a	20.34 b	20.25 b	
	Second year: 2013											
Control	3.36 bc	3.15 c	3.76 ba	3.42 b	31.00 bc	22.58 e	23.96 ed	25.85 d	29.38 cd	20.60 fe	14.40 g	21.46 d
EMS at 0.1%	3.50 b	3.56 b	3.95 ab	3.67 ab	31.71 b	31.08 bc	30.00 c	30.93 b	36.47 bc	27.67 d	31.56 c	31.90 b
EMS at 0.2%	3.61 b	3.20 c	3.99 ab	3.60 ab	35.92 ab	32.60 b	31.10 bc	33.21 ab	38.40 b	29.70 cd	20.55 fe	29.55 b
EMS at 0.3%	3.42 b	3.15 c	3.80 ab	3.46 b	32.00 b	25.16 d	26.67 d	27.94 bc	31.87 c	23.51 e	17.88 f	24.42 c
EMS at 0.4%	3.35 bc	3.10 c	3.75 ba	3.40 c	28.33 cd	23.20 e	25.00 de	25.51 d	30.00 cd	18.36 f	15.26 g	21.21 d
Colchicine at 0.1%(24hrs)	4.60 a	4.33 a	4.51 a	4.48 a	37.48 a	34.35 ab	34.02 ab	35.28 a	45.00 a	35.00 c	31.67 c	37.22 a
Colchicine at 0.1%(48hrs)	3.36 bc	3.12 c	3.80 ab	3.43 a	31.85 b	24.17 ed	25.20 d	27.07 c	31.33 c	19.00 f	21.33 ef	23.89 c
Mean	3.60 ab	3.37 b	3.94 a		32.61 a	27.59 b	27.99 b		34.64 a	24.83 b	21.81 b	

* EMS: Ethyl methane sulfonate.

* Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5 % confidence level.

However parallel observations were also obtained by El-Meligy (1981) and Misra and Bajpai (1983) on gladiolus, Han *et al.* (1999) on Asiatic hybrid lily and Silva *et al.* (2000) on the proto corm-like bodies of *Cattleya intermedia*.

According to the aforementioned results, it can be summarized that soaking corms of the three studied cultivars of gladiolus in 0.1% colchicine solution for 24 hours is one of the best methods for improving some morphological traits and corm production.

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تأثير بعض المطفرات الكيميائية على الصفات الظاهرية و إنتاج الكورمات لبعض أصناف الجلادبولس

هشام فخري الطبيب

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أجريت تجربتنا أصص بمشتمل حديقة انطوننيادس النباتية، قسم بحوث الحدائق النباتية، معهد بحوث البساتين، الإسكندرية، مصر خلال موسمي ٢٠١٢ و ٢٠١٣ وذلك لدراسة تأثير نفع كورمات ثلاثة أصناف من الجلادبولس، هم Eurovision (أحمر)، Nova Lux (أصفر)، Peter Pears (خوخى) في المحلول المائي للإيثايل ميثان سلفونات (EMS) بتركيزات صفر، ٠,١، ٠,٢، ٠,٣، ٠,٤ % لمدة ٢٤ ساعة أو الكولشيسين (Colchicine) بتركيزات صفر، ٠,١ % لمدة ٢٤ أو ٤٨ ساعة على النمو الخضري و إنتاج الكورمات.

ولقد أوضحت النتائج المتحصل عليها أن المستويات المختلفة من الإيثايل ميثان سلفونات ليس لها تأثير على موعد إنبات الكورمات، بينما أحدثت معاملات الكولشيسين تبيكيرا معنويا لإنبات الكورمات في كلا الموسمين، مع تفوق معاملة النقع لمدة ٢٤ ساعة والتي سجلت أقل عدد للأيام من الزراعة حتى الإنبات في كلا الموسمين. لم يكن هناك تأثير للصفة على هذه الصفة، حيث أنبتت كورمات الأصناف الثلاثة في توقيتات متقاربة. إلا أن أقل فتره للإنبات حققها الصنف Nova Lux عند معاملة بالكولشيسين (٠,١ %) لمدة ٢٤ ساعة في الموسم الأول، بينما حققها الصنف Peter Pears في الموسم الثاني بنفس المعاملة. أدت جميع المعاملات إلى زيادة ارتفاع النباتات عن الكنترول، لكن أطول النباتات تم الحصول عليها من الكورمات التي نقعت في محلول الأيثايل ميثان سلفونات بتركيز ٠,١ و ٠,٢ % لمدة ٢٤ ساعة. وبصفه عامه كانت نباتات الصنف Peter Pears أطول من نباتات الصنفين الآخرين، لكن أطول النباتات على الإطلاق أمكن الحصول عليها في الموسم الأول عند نفع كورمات الصنف Eurovision في محلول الأيثايل ميثان سلفونات بتركيز ٠,١ % ، بينما في الموسم الثاني تحقق ذلك بنفع كورمات الصنف Peter Pears في محلول الكولشيسين (٠,١ %) لمدة ٢٤ ساعة. أما أكبر عدد للأوراق / نبات فقد أمكن الحصول عليه في كلا الموسمين بنفع الكورمات في محلول الكولشيسين (٠,١ %) لمدة ٢٤ ساعة. ولقد أعطى صنفى Eurovision، Nova Lux في كلا الموسمين عددا أكبر للأوراق من الصنف Peter Pears، إلا أن أكبر عدد للأوراق على الإطلاق حققته الأصناف الثلاثة في كلا الموسمين كان عند معاملتها بمحلول الكولشيسين (٠,١ %) لمدة ٢٤ ساعة.

أيضاً فإن معاملة الكولشيسين بتركيز ٠,١% لمدة ٢٤ ساعة أعطت أكبر قطر وأثقل وزن طازج للكورمات الجديدة، وكذلك أكبر عدد للكريمات / نبات مقارنة بالكنترول و المعاملات الأخرى في معظم الحالات بكلا الموسمين. وبصفه عامة، أعطت معاملة الكولشيسين (٠,١%) لمدة ٢٤ ساعة أكبر قطر و وزن طازج للكورمات الجديدة للأصناف الثلاثة موضع الدراسة، كما سجلت نفس المعاملة أكبر عدد للكريمات / نبات في صنفى Eurovision & Nova Lux بينما تحقق ذلك للصنف Peter Pears بنقع كورماته في محلول ايثايل ميثان سلفونات (٠,١%) لمدة ٢٤ ساعة فقط. من هذه النتائج، يمكن التوصية بنقع كورمات الأصناف الثلاثة موضع الدراسة (Peter Pears ، Nova Lux ، Eurovision) في محلول الكولشيسين (٠,١%) لمدة ٢٤ ساعة قبل الزراعة مباشرة للحصول على أفضل مظهر للنمو وأعلى إنتاج للكورمات.