Current Science International 3(2): 122-131, 2014
ISSN: 2077-4435

Effect of Cobalt on Growth, Yield and Production Quality with Mitotic and Meiotic Divisions in Two Onion Cultivars

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ABSTRACT

The study was conducted to evaluate the effect of cobalt on two onion cultivars, Giza 6 Mohassan (Giza 6 M) and Shandweel 1(Shan1), for growth, bulb yield quantity and quality as well as to determine the effect of cobalt on germination %, mitotic and meiotic cell divisions at M1. Onion seeds were sown in trays filled with a mixture of sand and petmoss (1:1volume). Cobalt mixed with sand and petmoss in seven concentrations, 0.0, 2.5, 5.0, 7.5, 10.0, 12.5 and 15.0 ppm/kg soil. Onion seeds were sown in trays even to translocation and planting at research and production station, National Research Centre, El-Nobaria, Beheara Governorate, Egypt. During the growth period the obtained results indicate that: all cobalt levels significantly increased onion cultivars growth and yield. Cobalt at 10 ppm gave a significant promotive effect on the two onion cultivars growth, bulb yields quantity and quality such as nutrients and essential oils content along with bulb length, bulb diameter and weight. Higher cobalt concentration more than 10 ppm significantly reduced the promotive effect. The germination percentage was found to be 96% for Giza 6 M and Shan 1 at 7.7and 10.0 ppm cobalt for the two varieties respectively, while the lowest percentage noted at 12.5 and 15.0 ppm cobalt for Giza 6 M and 5.0, 12.5 and 15.0 ppm for Shan 1. Also the percentage of mitotic index increased with the dose reached its maximum value at 10.0 ppm cobalt compared to control. The percentage of chromosomal aberrations increased in the two varieties under cobalt treatment in both mitotic and meiotic divisions. The most frequent type of aberration was stickiness followed by micronucleus and laggard chromosome. Disturbance of phase index was observed after treatment at the highest dose 15.0 ppm mainly in prophase and telophase. The results demonstrated that cobalt treatment have a beneficial effect to mitotic and meiotic at low doses while adverse effect was observed at high doses which may affect the onion yield. Therefore, the study recommends farmers and breeders by using 7.5 ppm cobalt /kg soil to improve the germination of seeds for Giza 6 Mohassan and 10.0 ppm cobalt /kg soil for improve Shandweel 1 germination. For high-yield and bulb quantity and quality the results recommended using 10.0 ppm cobalt /kg soil for both cultivars.

Key words: Onion, Cobalt, Yield, Mitotic, Meiotic, Mitotic index, Chromosomal aberrations.

Introduction

Onions with other members of the Allium family Onion (*Allium cepa* L.) are generally consumed for their flavour and their nutritive value (Benkeblia, 2003). Onion is considered to be one of the major vegetable winter crops in Egypt and increasing the production of good quality of onion, under the Egyptian environmental condition, is an important target by the growers to fulfill the export and local market requirements (Marey *et al.* 2012). The average bulb yield/fed in Egypt is still in need to be improved to face the increasing demand of onion. Genetic improvement of onion by conventional methods is slow due to its heterozygous, out crossing and biennial nature. So the inducing of mutations could be a useful tool.

Sharma and Talukder (1987) stated that, the solubility of the metals in water is of much greater importance. The degree of dissociation of metallic salts and the rate of absorption affect significantly the frequency of chromosomal aberrations. Yildiz *et al*. (2009) evaluated the genotoxic effects of copper sulphate (CS) and cobalt chloride (CC) on the anaphase – telophase chromosome aberration in *Allium* root growth inhibition test, the concentrations of CS and CC are 1.5 and 5.5 ppm, respectively. Mitotic index (MI) decreased in all concentrations tested of CS and CC compared to the control at each exposure time. The bridge, stickiness, vagrant chromosomes, fragments, c-anaphase and multipolarity chromosome aberrations were observed in anaphase–telophase cells. The total chromosome aberrations were more frequent with an increasing in the exposure time and the concentrations of both chemicals. In all the concentrations, CS and CC induced a significant increase in DNA damage.

Cobalt is an essential element for the synthesis of vitamin B12 which is required for human and animal nutrition (Young, 1983 and Smith, 1991).

In spite of the absence of evidence for direct role of cobalt in plant metabolism, it is considered to be a beneficial element for higher plants and is a kind of trace element and heavy metal found in soil (Hanson *et al.*,

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2001). Low cobalt levels significantly increased tomato yields (Nadia Gad, 2005), Squash (Aly ,1998), cucumber (Nadia Gad *et al.* 2008; Helmy and Nadia Gad 2002) pointed that cobalt (25 and 50 mg/kg soil) had a significant beneficial effect on the status of N, P, K, Ca and Mg in parsley leaves as well as Mn, Zn and Cu contents. Cobalt excess induces yield reduction and an inhibition in assimilates production in leaves and even inhibits the export of photo assimilates to roots and other sinks (Chatterjee and Chatterjee, 2003). Nadia Gad *et al.*, (2011) found that the amendment of cobalt to the soil improved the growth and yield parameters of faba bean. Aziz *et al*. (2013) reported that cobalt significantly increased all growth and yield parameters in sweet basil plants compared with control.

Onions as an important crop in Egypt in quality and quantity of the bulb yield, and the use of cobalt may ministering breeders onions in quick access to this goal. It is still need to improve, so the aim of this study was to investigate the effects of cobalt on onion seed germination percentage, important economical characters of M1 generation .i.e, growth, yield bulb quantity and quality of two onion cultivars under drip irrigation system as well as, evaluate the effect of cobalt on meiotic and mitotic divisions on M1 generation.

Materials and Methods

This study was carried out on the two local cultivars of onion (*Alium cepa* L.), Giza 6 Mohassan (Giza 6 M) and Shandweel 1(Shan1), in order to study the effect of cobalt sulfate at 0,2.5, 5.0, 7.5, 10.0, 12.5, 15.0 ppm / kg soil on seed germination %, important economical characters of M1 generation i.e, growth, yield bulb quantity and quality under drip irrigation system. Also, cytological studies of mitotic and meiotic cell division on M1 generation were studied.

A) Field experiment:

Field experiments were growing during two years (2010-2011/2011-2012) at Research and Production Station, National Research Centre, El-Nobaria, Beheara Governorate, Egypt, at mid September 2010. Seeds of onion were sown in filled trays.

Soil analysis:

Physical and chemical properties of El-Nobaria Soil were determined and described by Blackmore (1972). Soil pH, EC, cations and anions, organic matter, $CaCo_3$, total nitrogen and available P, K, Fe, Mn, Zn, Cu were run according to (Black *et al*., 1982). Determination of soluble, available and total cobalt was determined according to method described by (Cottenie *et al*., 1982). Some physical and chemical properties of El-Nobaria soil are shown in Table (1).

Table 1: Some physical and chemical properties of El-Nobaria soil.

Physical properties											
Particle size distribution%						Soil moisture constant%					
Sand	Silt	Clay	Soil texture			saturation			FC	WP	AW
70.8	25.6	3.6	Sandy loam			32.0			19.2	6.1	13.1
Chemical properties											
				Soluble cations (meq^{-1}L)				Soluble anions (meq-1L)			
pH 1:2.5	EC (dSm^{-1})	$CaCo_3$%	OM%	Ca^{++}	Mg^{++}	K^+	Na^+	HCO_3-	CO_3	Cl^-	SO4^{--}
8.49	1.74	3.4	0.20	0.8	0.5	1.6	1.80	0.3	-	1.9	0.5
Cobalt	Total	Available	Available micronutrients								
(ppm)	(mg 100 g^{-1} soil)		(ppm)								
Soluble	Available	Total	N	P	K	Fe	Mn	Zn	Cu		
o.35	4.88	9.88	15.1	13.3	4.49	4.46	2.71	4.52	5.2		

FC (Field Capacity), WP (Welting Point), AW (Available Water).

The studied doses of cobalt according to Jackson (1973) were used with a mixture of sand and peatmoss (1:1Volume). Trays being kept under green house condition. The bulbs produced from seedling (at 25 Cm) were translocated and planted in November 2010 at El-Nobaria farm and M1 bulbs were harvested. Bulbs produced were planted in next year at rows 3 meters long and 70 cm apart with distance of 30 cm between plants to bloom in spring of 2012. Then the pollen mother cells (PMCs) were obtained for meiotic studies. A complete randomized block design in three replicates was applied, with practicing all agricultural management required for production of onion.

1) The effect of cobalt treatments on seed germination percentage:

The percentage of germination was recorded as a number of germination treated seed x 100 compared with the non treated seeds.

2) Measurement of onion growth parameters:

After 45 days from transplanting, plant height, leaves number/plant as well as leaves fresh and dry weights were determined according to FAO (1980).

3) Measurement bulb yield quantity and quality:

After 130 days from transplanting yield parameters such as bulb length, bulb diameter, bulb weights along with total bulb yield (ton/fad) were determined according to (Gabal *et al.*, 1984).

4) Measurement of onion chemical and nutritional compositions:

The content of chemical and nutritional compositions were determined as following :

4-1) Stable and volatile oils:

In onion bulb, stable and volatile oils were determined according to A.O.A.C (1990).

4-2) Minerals compositions:

Nitrogen, sulphur and cobalt in onion bulb were determined according to (Black *et al.*, 1982).

B) Cytological studies:

The cytological studies were carried out on M1 generation. The root tips of germinated treated seeds were used for mitotic division and Pollen mother cells were fixed and killed in a fixative solution for meiotic division studies.

Mitosis:

Each treatment consists of 5 bulbs in three replicates. The fresh roots were collected and tips gathered, washed and fixed in Carnoy's fixative. Aceto-orcein squash technique was used in preparing the root tip for cytological examination, Mitotic index, phase index and chromosomal aberrations.

Meiosis:

Buds were collected at 9.30 – 11.30 a.m and the pollen mother cells (PMCs) were obtained for meiotic studies, and immediately fixed in Carnoy's, to examine the meiotic division, the contents of the anthers were squeezed out on a slide gently by a needle in a drop of aceto-orcien stain. Flower buds were investigated for each treatment. Abnormalities were counted in the 1st and 2nd meiosis in the pollen mother cells.

Statistical analysis:

Statistical analysis of the obtained data for the two onion cultivars were subjected to standard analysis of variance procedure. The values of LSD were calculated at 5% level according to Snedcor and Cochran (1980).

Results and Discussion

A) Field experiment:

The effect of cobalt treatments on seed germination % and yield parameters as vegetative growth, bulb quality and quantity were studied for the two onion cultivars:-

1) The effect of cobalt treatments on seed germination percentage:

Data obtained in Fig. (1) showed that germination % in the variety Giza 6 M was gradually increased as cobalt increased except at the three doses 10.0, 12.5 and 15.0 ppm respectively. In case of Shan 1the highest germination % was at the dose 10.0 ppm and the lowest germination % was at 15.0 ppm. Generally, there was a significant difference in germination % in the two studied varieties at different cobalt treatments. This result was in agreement with (Joshi *et al*., 2011) and confirmed by (Yildiz et *al*., 2009), hence they found an inhibition in growth root of Alliums with 1.5 ppm copper sulfate and 5.5 ppm cobalt chloride, respectively.

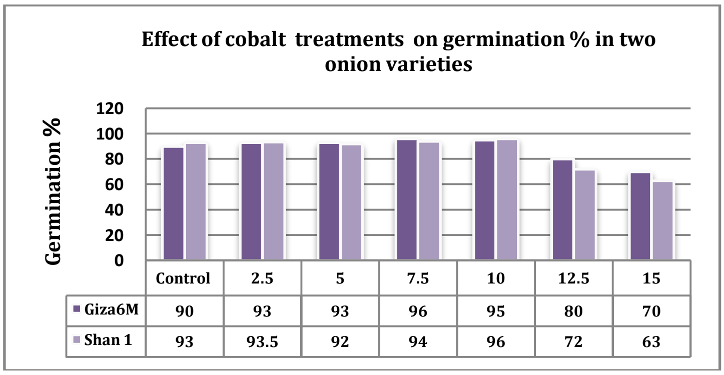

Fig. 1: Effect of cobalt treatments on germination % for two studied *Allium cepa* varieties.

2-)Measurement of onion growth parameters:

The present data in Table (2) showed that addition of different cobalt levels to the growth media significantly increased all growth parameters of onion cultivars. All doses significantly exceeded the control treatment, for plant height (cm), leaves number/plant; fresh and dry leaves, weight/plant (gm), but the highest values were obtained in plants treated with 10 ppm cobalt. Increasing cobalt levels above 10 ppm reduce the promotive effect.

These results are in coincide well with those obtained by Nadia Gad (2005) who stated that cobalt at 7.5 ppm induced with positive effect due to several it's in hormonal synthesis (Auxins, Gebrillens) and metabolic activity in tomatoes and hence increase in Anabolism rather than catabolism. The author demonstrated that the activity of some enzymes such peroxidase and catalase increased with excess cobalt doses indicating an effect on catabolism rather than anabolism.

Table 2: Effect of cobalt on vegetative growth of onion cultivars Giza 6 M and Shand 1 in M1 generation.

Varieties	Cobalt treatments (ppm)	Plant height cm	Leaves number/plant	Leaves weight/plant gm	
				Fresh	Dray
Giza 6 M	Control	53.2	6	22.71	5.30
	2.5	54.5	6	22.90	5.35
	5.0	56.0	7	23.42	5.66
	7.5	56.6	7	26.93	8.12
	10.0	65.3	8	38.01	15.08
	12.5	62.0	8	35.12	13.12
	15.0	58.3	8	31.85	10.64
Shan 1	0.0	50.3	6	19.30	4.81
	2.5	50.7	6	19.51	4.92
	5.0	51.6	6	21.06	5.03
	7.5	52.9	6	23.13	7.64
	10.0	58.5	7	36.50	12.90
	12.5	54.2	7	32.72	11.22
	15.0	50.6	7	28.64	9.91
LSD5%		0.4	1	0.21	0.11

*significant at 0.05%

3) Measurement bulb yield quantity and quality:

Parameters of yield such as bulb length, bulb diameter, bulb weights along with total bulb yield (ton/fad) were determined as clearly observed from the data in Table (3). The amendment of cobalt to the soil improved yield parameters such as bulb length, bulb diameter and weight as well as total bulb yield (ton/fed) compared with untreated plants. Values of onion yield were gradually increased markedly with increasing in cobalt doses from zero to 10 ppm cobalt and the dose 10 ppm cobalt gave the greatest bulb yield. Increasing cobalt level in plant media more than 10 ppm resulted in proportion significant reduction in promotive effect. These results agree with those obtained by Nadia Gad and Hala Kandil (2008) who stated that all cobalt levels had a significant promotive effect on the sweet potato roots yield.

Table 3: Effect of cobalt treatments on onion yield quantity and quality for Giza 6 M and Shan 1 varieties in M1 generation.

Varieties	Cobalt treatments (ppm)	Bulb length cm	Bulb diameter cm	Bulb weight gm	Total bulb yield (Ton/fed)
Giza 6 M	Control	4.29	3.24	82.3	6.02
	2.5	4.46	3.66	84.5	6.19
	5.0	4.71	4.11	88.2	6.48
	7.5	4.88	4.86	96.6	6.90
	10.0	6.13	6.20	122	7.11
	12.5	5.96	6.01	113	6.78
	15.0	5.90	6.01	109	6.19
Shan 1	0.0	3.94	3.09	79.5	5.61
	2.5	3.98	3.11	81.3	5.72
	5.0	4.19	3.14	84.5	5.84
	7.5	4.32	3.15	88.8	5.96
	10.0	5.87	5.91	103	6.88
	12.5	5.36	5.86	97.2	6.28
	15.0	5.11	4.90	86.0	5.89
LSD5%		0.4	0.2	1.5	0.6

*significant at 0.05%

4)Measurement of onion chemical and nutritional compositions:

The content of chemical and nutritional compositions were determined and presented in Table (4) as following:

4-1) Stable and volatile oil:

In onion bulb, stable and volatile oils were determined indicated that the stable and volatile oils of onion bulb were significantly increased with the application of different cobalt concentrations compared with control. Cobalt at 10 ppm gave the highest figures of onion oils. Increasing cobalt levels in plant media significantly reduced such the promotive effect. These results agree with those obtained by Helmy and Nadia Gad (2002) who pointed that the essential oil percentage of parsley leaves significantly increased with all cobalt levels compared with control. Also they reported that the most significant increase in oil percentage was obtained with 25 and 50 mg Co/Kg soil.

Table 4: Effect of cobalt on onion chemical and nutritional contents for Giza 6 M and Shan 1 varieties in M1 generation.

Varieties	Cobalt treatments (ppm)	Stable oil		Volatile oil		N	S	Cobalt (ppm)	
		%	Yield gm	%	Yield gm	%	%	Leaf	Bulb
Giza 6 M	Control	14.9	12.3	0.079	0.065	1.66	1.11	1.32	0.65
	2.5	15.3	13.0	0.082	0.070	1.71	1.16	1.36	0.68
	5.0	16.0	14.6	0.086	0.076	1.79	1.22	1.67	0.72
	7.5	19.6	18.9	0.089	0.108	1.95	1.32	3.50	0.78
	10.0	24.1	27.3	0.110	0.130	2.07	2.44	6.91	0.99
	12.5	22.4	21.0	0.077	0.090	1.92	2.23	7.97	1.62
	15.0	21.7	17.8	0.066	0.071	1.75	2.16	9.65	2.98
Shan 1	0.0	14.2	11.7	0.077	0.061	1.62	1.09	1.29	0.62
	2.5	14.8	12.4	0.081	0.065	1.65	1.13	1.32	0.65
	5.0	15.4	14.1	0.084	0.070	1.69	1.16	1.86	0.69
	7.5	18.7	18.2	0.086	0.108	1.91	1.29	3.47	0.75
	10.0	22.9	25.8	0.107	0.129	2.05	1.41	6.90	0.97
	12.5	20.8	19.6	0.074	0.089	1.90	2.2	7.63	1.57
	15.0	18.9	15.4	0.063	0.071	1.72	2.13	9.56	2.95
LSD5%		0.20	1.30	0.04	0.05	0.40	0.30	0.40	0.30

*significant at 0.05%

4-2) Minerals compositions:

The content of chemical compositions were determined as Nitrogen, sulphur and cobalt in onion the results showed the effect of cobalt on nitrogen and sulphur elements in the two cultivars onion bulbs. Data revealed that all cobalt doses significantly increased the content of N and S compared with control. The highest values of N and S content were obtained by cobalt 10.0 ppm. The higher concentrations of cobalt decreased the promotive effect. These results are in harmony with those obtained by Nadia Gad and Nagwa Hassan 2013, who showed that cobalt significantly increased macro and micro nutrients in sweet pepper fruits compared with control.

Increasing cobalt doses in plant media from 2.5 up to 15.0 ppm increased cobalt content in onion bulbs as compared with control. The obtained results are in agreement with those obtained by (Nadia Gad *et al.*, 2013). Young (1983) reported that the daily cobalt requirements for human nutrition could reach 8 ppm cobalt depending on cobalt levels in local supply of drinking water without health hazard.

Our results indicated that cobalt level reached to 6.91 and 6.90 ppm in the leaves of the two cultivars respectively. In onion bulbs such levels reached to 2.92 and 2.95 ppm (in two cultivars) after treatment with the highest tested dose (15.0 ppm). Such level is below the dangerous level, since the daily consumption of onion bulbs does not exceed a few grams.

B- Cytological studies:

Onion root tips were examined cytologically to study the effectiveness of cobalt supplement in suppressing or promoting development and to study also the sensitivity of cells at different stages, to various doses of cobalt in the M1 generation.

Mitotic index:

The effect on mitotic index percentage showed in Table (5). The results indicated that not all doses generated negative effects. The percentage of mitotic index (M.I.) significant increase at 10.0 ppm cobalt which exceeded the control values. Such percentage decreased with increasing the dose higher than 10.0 ppm reached its maximum value at the dose 15 ppm.

Our results are compatible with (Marcano *et al*., 2004) who considered mitotic index as a parameter that allows one to estimate the frequency of cellular division. However, either the increase or decrease in the mitotic index (MI), are important indicators in monitoring environmental pollution (Fernandes *et al*., 2007).

The suppression of mitotic activity was probably due to either the blocking of G1, suppressing cells from DNA synthesis (Schneiderman *et al*., 1971) or the blocking of G2, preventing cells from entering mitosis (Van't Hof, 1968).

Table 5: Effect of different doses of cobalt, on mitotic index and phase index for two *Allium cepa* varieties.

Varieties	Dose	% M.I.	Mitotic stage			
			Prophase	Metaphase	Anaphase	Telophase
Giza 6M	Control	12.3±1.2	19.92±0.38	31.77±1.66	27.95±0.43	20.3±0.61
	2.5	12.72±0.88	20.25±0.9	29.1±0.85	32.75±0.36*	18.9±0.36
	5.0	12.88±1.13	19.39±0.3	30.9±0.85	33.12±0.78*	16.59±0.37*
	7.5	13.36±1.75	20.42±0.62	25.4±0.53*	32.79±1.69*	21.39±0.5
	10.0	15.33±2.33*	21.8±1.84*	26.2±1.99*	28.4±1.47	23.6±0.5
	12.5	10.03±2.05*	20.02±0.5	34.5±0.51*	26.98±0.5	18.5±0.61
	15.0	8.6±1.49**	16.7±0.61**	36.1±0.56*	30.5±0.63*	16.7±0.7*
	Control	11.2±0.65	20.6±0.27	34.6±0.81	24.99±0.51	19.7±0.53
Shan1	2.5	11.36±0.82	23.2±0.6	31.6±0.71	28.4±0.72*	16.8±0.5*
	5.0	11.79±0.87	18.86±0.8	27.33±1.15*	31.81±0.73**	32.0±0.53**
	7.5	12.14±1.75	24.01±0.72*	32.0±0.85	27.5±0.58*	17.02±0.61
	10.0	13.14±1.83*	20.3±0.5	39.7±0.51*	24.5±0.53	15.5±1.0*
	12.5	9.25±0.73	18.6±0.53	31.2±0.55	24.5±0.99	25.7±0.5*
	15.0	7.9±0.53**	13.9±0.53**	29.1±1.47*	27.8±0.49*	28.5±0.61**

(Mean ± SD), * = Significant at 0.05, ** = high Significant at 0. 1)

The effect of cobalt treatments on mitotic stages:

The effect of cobalt on mitotic stages showed in Table (5). Mitotic stages for Shan1 were found to be more sensitive than Giza 6 M. In comparison for control Giza 6 M showed highest values in prophase at 10.0, metaphase at 15.0ppm, while anaphase and telophase at 5.0and 10.0 ppm respectively. Shan1 showed highest values for prophase at 7.5 ppm and metaphase at 10.0, for both anaphase and telophase at 5.0 ppm.

It is clear that the effect of varying doses on the stages of mitotic depends completely on the genetic background of the cultivars. Other notable that this dispersion effect of doses can show its influence on the percentage of chromosomal abnormalities and hence the yield of plants will be affected in the end, either positive or negative. In general, our results for mitotic stages were in agreement with (El-Ghamery *et al.,* 2003; Seth *et al*., 2008 and Rank, 2003).

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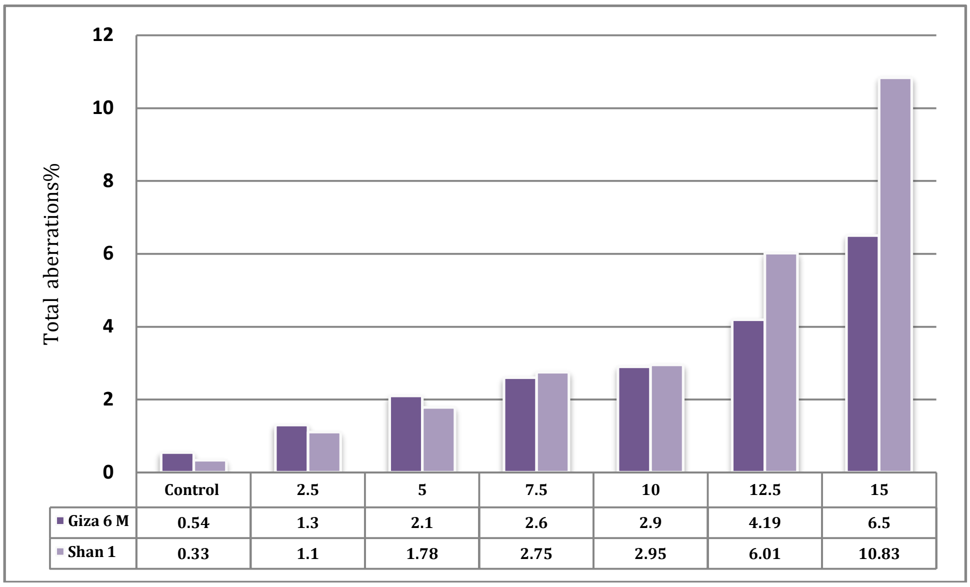
The effect of cobalt treatments on chromosomal aberration percentage:

The changes in the organization and morphology of the chromosomes were observed as percentage of total chromosome aberrations. The percentage of abnormalities for two cultivars was shown in Fig. (2). The abnormalities increased with increasing the cobalt doses in comparison to control for the two cultivars.



	Control	2.5	5	7.5	10	12.5	15
Giza 6 M	0.54	1.3	2.1	2.6	2.9	4.19	6.5
Shan 1	0.33	1.1	1.78	2.75	2.95	6.01	10.83

Fig. 2: Effect of cobalt treatments on total mitotic aberrations% for two *Allium cepa* varieties.

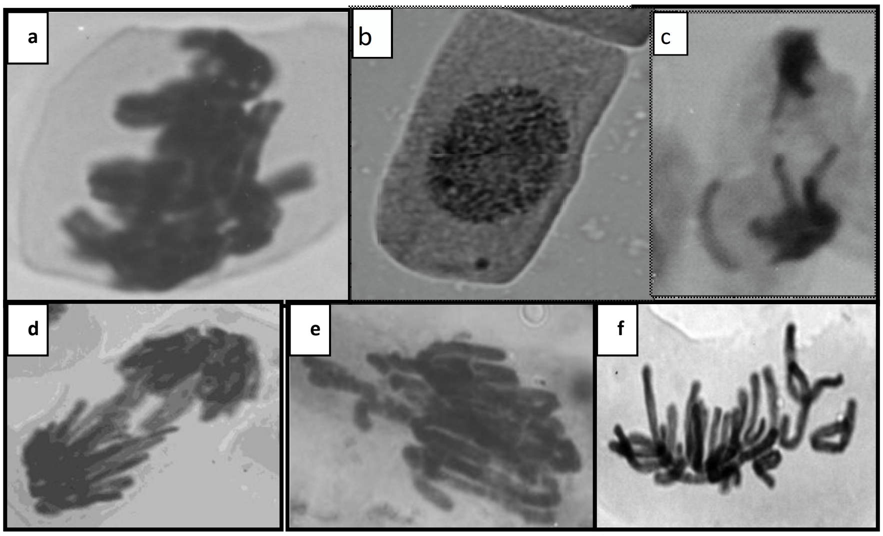


Fig. 3: Chromosomal aberrations induced by cobalt treatments in mitotic root tip cells of *Allium cepa*.(a) Stickiness; (b) Micronucleus; (c f) Laggard; (d) Bridges, (e) Fragmented chromosome (f) and forward chromosome.

Structural chromosomal alterations may be induced by several factors, such as DNA breaks, inhibition of DNA synthesis and replication of altered DNA. The numerical chromosomal aberrations, e.g. aneuploidy and polyploidy, are consequences of abnormal segregation of chromosomes, which can occur either spontaneously or by the action of aneugenic agents (Albertini *et al*. 2000). Also, (Amin, 2002) reported that chromosomal aberrations occur due to lesions in both DNA and chromosomal spindle protein causing genetic damage. The induction of mitotic abnormalities in root tip cells of plants may cause a decrease of mitotic index (Bushra *et al.* 2002). It is clear from data of cytological analysis, and our above results that, the alterations may be beneficial with low doses for the studied plants or potentially damaging in high doses.

The effect of cobalt treatments on meiotic division:

Data in Table (6) revealed the percentage number of different stages of meiotic division and its observed cells in the two varieties. The higher number of observed cells showed in Shan 1 treated with 2.5 ppm, while the lowest number of cells observed in Giza 6 M at 15.0 ppm. The both varieties in diakinesis showed the highest number of cell percentage at 5.0 ppm.

Table 6: Effect of cobalt on percentage of meiotic phases for two Allium *cepa* varieties.

Variety	Dose	Observe cells	Phases of Meioses						
			D	MI	AI	TI	MII	AII	TII
Giza 6 M	Control	2312	36.35	19.3	0.8	30.9	1.0	0.02	5.64
	2.5	2157	42.03	15.04	0.52	32.0	1.4	0.2	6.95
	5.0	2235	62.7	20.0	2.45	11.0	0.75	0.0	3.1
	7.5	2197	55.2	6.21	3.03	22.3	4.2	1.06	8.0
	10.0	1945	19.06	27.2	4.2	21.2	13.13	0.99	14.22
	12.5	1934	15.2	18.3	2.6	30.7	6.1	0.65	11.5
	15.0	1876	35.74	8.8	4.52	3.65	0.09	1.07	3.44
Shand 1	Control	2217	26.07	2.95	0.73	43.5	6.5	3.75	16.5
	2.5	2239	19.5	0.95	2.3	26.2	11.35	2.5	37.2
	5.0	2177	31.4	3.02	2.1	45.66	4.47	0.0	3.35
	7.5	2213	15.08	0.26	0.08	21.5	15.2	0.5	5.8
	10.0	2008	13.07	4.85	0.63	24.57	12.22	0.24	4.42
	12.5	1960	21.9	9.85	3.53	33.38	4.88	1.1	18.36
	15.0	1948	23.5	11.51	4.3	25.2	5.1	0.95	21.0

In metaphase I comparison with control the both varieties Giza 6 M and Shan 1 had the highest percentage number of cell division at 10.0 ppm and 15.0 ppm doses respectively, at anaphase I showed high values at 15.0 ppm for both varieties, telophase I was highest in Giza 6 M at 2.5 dose and Shan 1 at 5.0 ppm.

At metaphase II the percentage of cell numbers was highest values comparison with the control at 15.0 and 2.5 ppm for Giza 6 M and Shan 1 respectively.

The treatment of 2.5 dose showed high values in Anaphase II and Telophase II for Shan 1, while Giza 6 M was high in Anaphase II at 15.0 ppm and Telophase II at 10.0 ppm.

This disturbance in the distribution of cell division of meiotic phases may show its effect on formation of cells and then the yield quality and parameters of growth. These Changes may be in favor or against the plants by doses and type of treatment, (Adam *et al.*, 2008; Schulz - Scheeffer, 1980 ; Amer and Ali, 1988).

The effect of cobalt on meiotic total chromosomal aberrations on two Allium varieties:

The percentage of meiotic abnormalities was observed as shown in Fig. (4). A great variability in the percentage of abnormalities was observed, where it ranged from 5.85% at the control to 83.50% at 5.0 ppm in Giza 6 M, and from 3.39% at control to 37.5 % at the dose 15.0 ppm in Shan 1, the effect of cobalt was more pronounced in the variety Giza 6 M than in Shan 1.

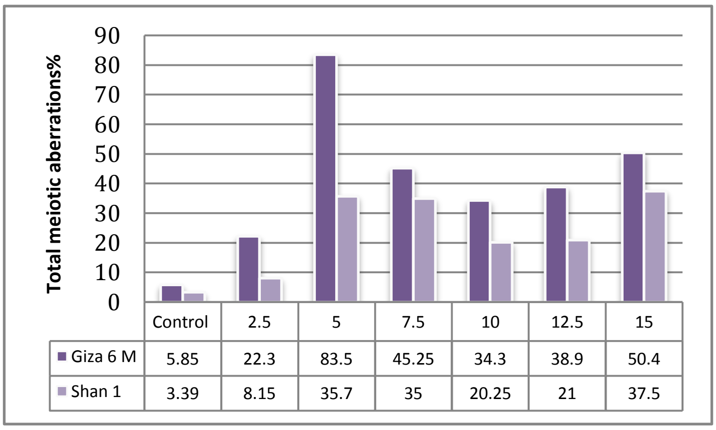


Fig. 4: Effect of cobalt on two Allium varieties in meiotic total chromosomal aberrations.

The chromosomal aberrations in meiotic showed in many types were observed in fig. (5) as Stickiness (a-b), micronucleus (c), bridge (f) and lag bivalent (k). The results were in agreement with (Paglıarıni, 2000; Vicccini and Carvalho, 2002).

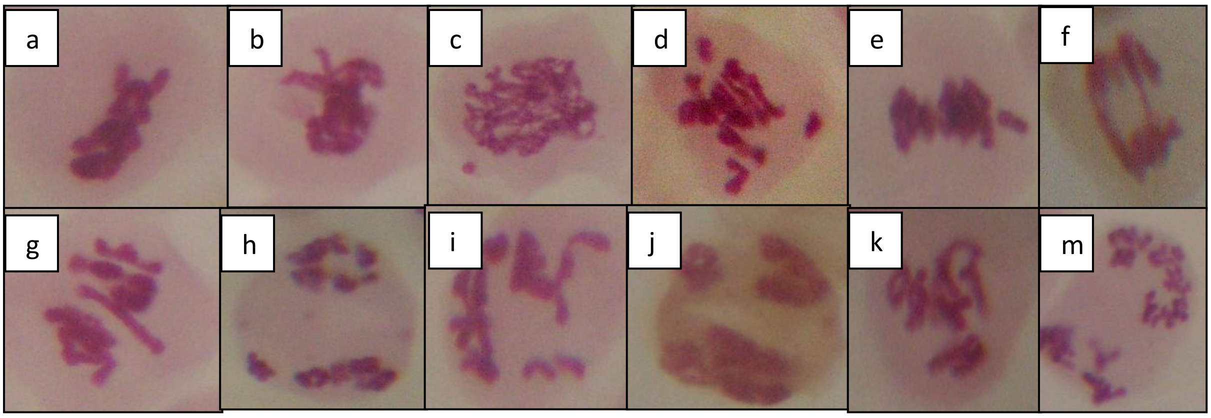


Fig. 4: Chromosomal aberrations induced by cobalt treatments in meiotic cells of *Allium cepa*. (a-b) stickiness; (c) micronucleus; (d-e) fragment; (f) bridge; (g) sticky metaphase II; (h) laggard bivalent; (i) disturbed metaphase II; (j) sticky anaphase II; (k) lag bivalent and (m) disturbed anaphase I.

Conclusion:

Onions as an important crop in Egypt. It is still need to improve in quality and quantity of the bulb yield, and the use of cobalt may ministering onion breeders in quick access to this goal. The study recommends farmers and onion breeders by using 7.5 ppm cobalt /kg soil to improve the germination of seeds of Giza 6 Mohassan and 10.0 ppm /kg soil to improve germination Shandweel 1. For high-yield and bulb quantity and quality is used 10.0 ppm /kg soil for both cultivars.

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