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Effect of Diatomite, Putrescine and Alpha-Tocopherol on flower characters and Anatomical flower bud structure of *Antirhinum majus* L. plant

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ABSTRACT

The experiment trial was consummated throughout two successive seasons (2011/2012 and 2012/2013) at the nursery of Ornamental Horticultural Department, Faculty of Agriculture, Cairo University, Giza, Egypt. This work was to study the effect of diatomite at the rate of (10,20 and 30%), putrescine at the rate of (100,200 and 300ppm) and alpha tocopherol at the rate of (400,800 and 1200 ppm) in addition to control (distilled water) on flowering and anatomical structure of *Antirrhinum majus* L. plant during (2011/2012 and 2012/2013) seasons. Using diatomite at the rate of 30% gave the highest increase in all characters of flowering, development for floral bud which was earlier than other concentrations 10 and 20%.Application of putrescine at the concentrations of 200 ppm gave the best results in all characters of flowering, a decrease in number of days for flowering than control plants in both seasons. Treated plants with 800 ppm alpha tocopherol gave the highest significant increase in all flower characters and gave a lowest day to first flower appearance in both seasons than other treatments (400 and 1200ppm).

***Keywords*: *Antirrhinum majus*, flowering, anatomical bud structure.**

Introduction

Antirrhinum majus L. plant is commonly known as Snapdragon belongs to family Scrophulariaceae, native to the Mediterranean Region. Snapdragons are usually planted as bedding annuals, often with petunias or pansies. For landscape dwarf snapdragon cultivars are excellent for border edges or raised beds and rock gardens. Growing flower crops compared with traditional crops provide more marketing at both small and large scale for growers and it becoming more selective choice nowadays. (Grigatt, 2008). Diatomite is naturally occurring in siliceous sedimentary mineral compound from microscopic skeletal remains of unicellular algae- like called diatoms. Diatomite Improve the physical structure of the soil (it helps to break up heavy clay based soils as well as retain moisture for longer periods in light or sandy soils), enhances movement of water to root zone and provides a slow release of nutrients (it acts as a fertilizer carrier). (Hellal *et al*., 2012). Polyamines are unbranched aliphatic die-, tri-, and tetra- amines, e.g. putrescine, spermidine, spermine, respectively. Polyamines possess diverse biological functions and are formed during metabolic processes in living organisms. They in plants are involved in many steps of protein synthesis, embryogenesis, transcription of genes, cell division, organ developments, fruit ripening, leaf senescence, tuber dormancy and stress minimization of plant organs. Putrescine concentration increases in plants in response to a number of stress factors including water stress, acid treatment, mineral deficiency, and osmotic shock or CO_2 treatment, (Kosson and Prange, 2005). Vitamin E (Alpha-tocopherol) is an essential vitamin for humans and animals. However, it is exclusively synthesized in photosynthetic organisms (Della Penna, 2005). Vitamin E is also a powerful biological antioxidant phytoregulator compounds (Vitamin E) suggested to elevate and tolerate the adverse effects of biotic and abiotic stresses such as moisture and salt stress on plant growth and yield (Demiral and Turkan, 2005).

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The aim of this study was to investigate the effects of diatomite, putrescine and alpha tocopherol on flowering and bud anatomical structure of *Antirrhinum majus* L. plant.

Materials and Methods

The experiment trial was consummated throughout two successive seasons (2011/2012 and 2012/2013) at the nursery of Ornamental Horticultural Department, Faculty of Agriculture, Cairo University, Giza, Egypt. The aim of this work was to study the effect of diatomites addition before transplanting and foliar spraying with different levels of Putrescine and alpha-tocopherol on flowering and anatomical flower bud structure of *Antirrhinum majus* L. plant.

Antirrhinum majus L. Plant dwarf bicolor seedlings were obtained from Egypt green farm, Giza, Egypt. The seedlings were obtained and transplanted in clay pots (25 cm diameter) filled with 4 Kg of growing media from clay and sand at the ratio of 1:1 (v/v). The length of seedlings was 10 cm and carries 2 pairs of leaves.

Diatomite were added a week before transplanting at the rate of (10%, 20% and 30%) when the height of seedlings were about 12 cm and had about 6 leaves (after about one week from first fertilizing on 22th of November in both seasons).

Seedlings were sprayed with Putrescine at the concentrations of (100,200 and 300 ppm) and vitamin (E) Alpha tocopherol at the concentrations of (400, 800 and 1200 ppm), while the control plants were sprayed with distilled water till the run off point. Nine treatments plus control were carried out, and having three replicates, while each replicate contained fifteen plants / pots. The plants were sprayed with Putrescine and alpha tocopherol three times (15thDecember, 1st January and 15th January) for the first and second season.

Anatomical structure:

Samples were taken from the eighth branch on the plant after 55 days from transplanting and transfered to the laboratory they were cleaned with tap water cutted into suitable parts, killed and fixed in FAA. Solution (10ml formalin,5 ml acetic acid and 85 ml ethyl alcohol 70%),dehydrated in different concentrations of ethyl alcohol, clearing in different concentrations of ethyl alcohol+Xylene, infiltrated and embedded in pure paraffin wax (M.P.58-60 cº) Johansen (1940).Sectioning at thickness of 20 µ was performed by using a rotary microtome. Paraffin ribbons were mounted on slides and sections stained with safranine and fast green (Corgen and Widmayer,1971).Sections were mounted in Canda balsam then examined microscopically and microphotography.

Data recorded:

Number of inflorescences/plant, Yield of (g)/plant, Length of raches (cm), Number of days from transplanting to the opening of the first flower bud referred to flowering date/day, fresh and dry weight of inflorescences /plant and anatomical bud structure.

Statistical analysis:

Data in the two seasons were statistically analyzed as described by Snedecor and Cochran (1980). Means of all characters were compared using L.S.D test at 0.05 level of significance. The layout of the experiment was a complete randomized block design.

Result and Discussion

Flower characters:

Data presented in Table (1) showed that using diatomate at the concentrations of 10,20 and 30% in the soil increased No. of inflorescences/ plant yield of spike (g/plant), raches length (cm/plant), fresh and dry weight of inflorscences /plant compared with untreated onse, the best results were found when plants treated with 30% diatomite. These results are harmony with those obtained by Wang *et al*.,(2011) on soyabean, Ogabaji *et al*.,(2013) on three cultivar of tomato, Tahir *et al.,*(2013) on sunflower, Moon *et al*., (2008) on Chrysanthemum plant, Kamenidou *et al.,*(2010) on Gerbera plants, they all found that treating the plants with diatomite increase inflorescnces characters. This might be due to the role of silicon on inhibiting the nutrients imbalance in the process of plant

growth and production. (Ma and Takahashi 2002). Silicon supplementation enhanced endogenous gibberellins production in rice seedlings that can led to stem elongation. (Jang *et al*., 2003).

Data in Table(1) showed that plants treated with all concentrations of putrescine significantly increased No. of flower inflorescences/ plant yield of spike (g/plant), raches length (cm/plant), fresh and dry weight of inflorscences /plant compared with untreated Plants in both seasons. The highest values for these characters were found when plants treated with 200 ppm putrescine. Our results were agreement with those obtained by Youssef (2011) on *Populus species,* El-Quesni *et al.* (2010) on *Syngonium podophyllum* L. plants, Abd El-Aziz *et al.* (2009) on gladiolus plants. . The stimulative effect of PAs on yield component may be due to the effect of PAs which serves as specific protective agents in plants exposed to extreme environment Kuhen *et al*. (1990).

Concerning the effect of foliar application of alpha-tocopherol (vitamin E) at the different concentrations 400,800 and 1200 ppm on *Antirrhinum majus* L. plant on No. of flower inflorescences/ plant, yield of spike (g/plant), raches length (cm/plant), fresh and dry weight of inflorscences /plant data revealed that, all concentrations were significantly increased all characters compared with control plants in the first and second seasons the highest values were found by application of 800 ppm alpha-tocopherol (vitamin E). These results are similar to those obtained by Al- Qubaie (2012) on sunflower plants cv. Giza 102. Mahgoub *et al.* (2011) on *Dahlia pinnata* L. plants. The increases in previous characters might be due to the effect of vitamins as antioxidant, which enhance protein synthesis causing delaying throw retarding ethylene production and increasing amino acids and some mineral formation and senescence; El–Bassiouny *et al.* (2005).

Table 1: Effect of diatomite (DM), putrescine (put) and alpha tocopherol (Toco) on some flower characters of *Antirrhinum majus* L. plant during 2011/2012 and 2012/2013 seasons.

Treatments	Number of inflorescenes No./plant)		Yield of Spike (g./plant)		Raches length (cm/plant)		Fresh weight of inflorescenes/plant		Dry weight of inflorescenes/plant	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	30.00	33.00	19.50	19.56	12.21	16.77	7.80	9.62	1.26	1.54
DM10 %	36.00	40.00	24.95	27.20	16.81	20.98	8.96	11.10	1.49	1.84
DM20 %	41.00	52.00	29.08	34.15	14.54	25.13	10.92	13.00	1.90	2.21
DM30 %	57.00	77.00	41.75	46.95	27.33	32.98	14.82	19.06	2.90	3.72
Put100 ppm	50.00	65.00	36.25	42.70	23.92	29.50	13.00	17.11	2.43	3.20
Put200 ppm	61.00	82.00	43.70	50.35	29.19	36.10	15.86	21.22	3.17	4.28
Put300 ppm	44.00	60.00	31.15	34.35	21.42	26.19	11.44	15.30	2.05	2.74
Toco400 ppm	46.00	63.00	33.09	36.01	22.56	28.19	12.22	16.30	2.22	2.98
Toco800 ppm	54.00	69.00	38.35	44.34	26.16	31.34	14.04	18.03	2.68	3.44
Toco1200 ppm	37.00	45.00	27.50	30.95	18.15	22.44	9.62	11.70	1.57	1.99
L.S.D at 0.5%	3.63	3.74	2.52	3.97	3.29	3.03	0.80	1.30	0.05	0.14

Number of days from starting flower:

Data in Fig. (1) mentioned that application of diatomite at the concentrations of (10, 20 and 30%) enhanced significantly flowering of *Airrhinum majus* L. plant by (3.07, 5.20 and 18.17) days in 1st season &(2.05,6.50 and 17.8) days in the 2nd season. These results were in agreement with those obtained by Haggag *et al.,* (2014) on annual bedding plants.

Treating the plants with putrescine at the concentrations of (100,200 and 300 ppm) significantly enhanced the flowering of *Antirrhinum majus* L. plant which started earlier than control in the first and second season, respectively. This effect may be due to the positive effect of putrescine on the physiological activities by formation of the photosynthetic and translocation from source to source to sink; El-Bassiouny *et al.* (2008).

Concerning the effect of alpha tocopherol treatments data showed that the plants treated with (400,800 and 1200 ppm) significantly decreased the number of days to the flowering of *Antirrhinum majus* L. plant.The application of 800 ppm was the most effective treatment by reducing the required period to the flowering through its effect on reducing ethylene production and subsequently increasing the amino acid and mineral assimilation. El-Bassiouny *et al.* (2005).

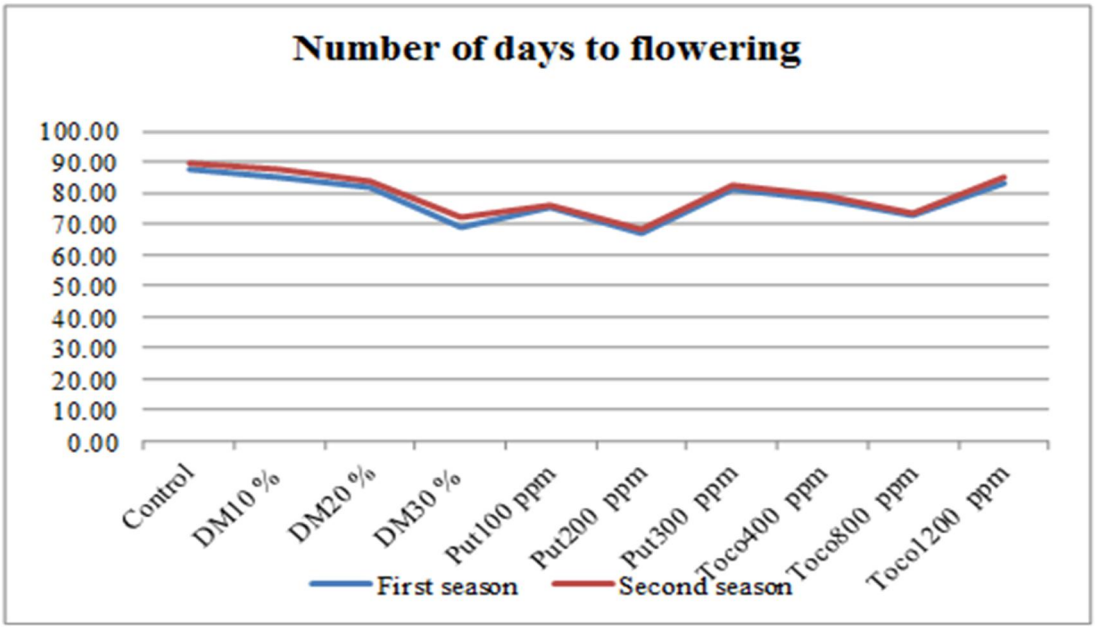


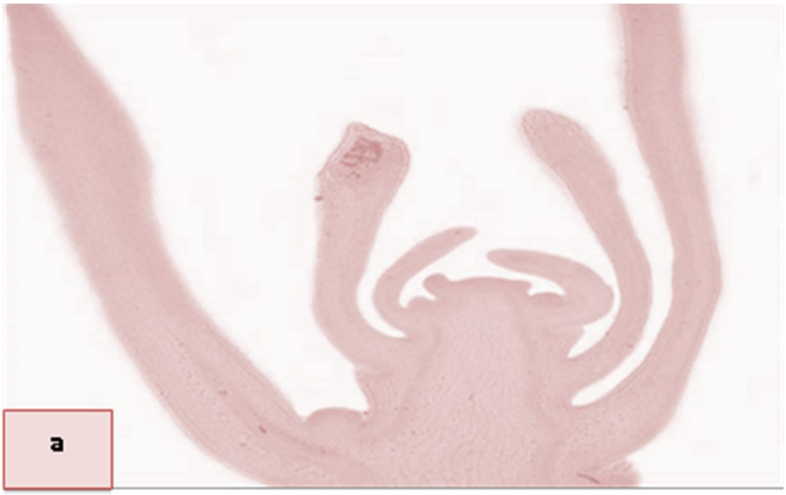
Fig. 1: Effect of Diatomite (DM), Putrescine (put), and Alpha-tocopherol (Toco) on number of days from starting flowers of *Antirrhinum majus* L. plant during 2011/2012 and 2012/2013 seasons.

3-Effect of diatomite, putrescine and alpha-tocopherol treatments on bud anatomical structure of *Antirrhinum majus* L. plant.

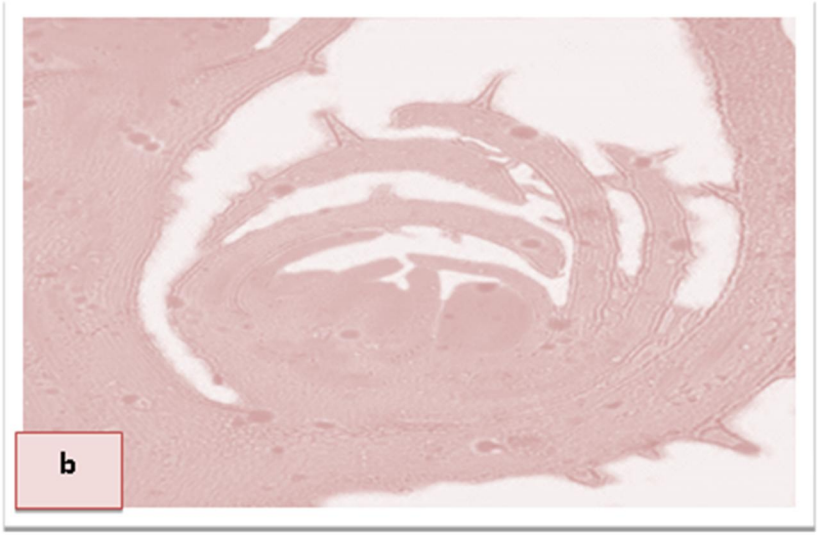
Data in Fig. (2) revealed that different behavior for floral induction and differentiation in *Antirrhinum* was found. Floral bud differentiation was observed at all treatments which confirmed the influence and changes in the differentiation pattern of axillary buds as compared with the control. Diatomite at 30% exhibited advanced formation and development of floral bud which was earlier than application of diatomite at 20% by (12.88 and 11.75 days) for first and second season, respectively, also it was earlier than diatomite at 10% by (15.85 and 15.42 days) for the first and second seasons, respectively, in addition this concentrate recorded from (18.08 and 17.80 days) below the control for first and second seasons ,respectively, from transplanting to the appearance of the first flower. So earliness in flowering enhanced by increasing concentration of diatomite, which caused changes in meristem sensitivity to internal and external signals of flower induction and that was verified by rapidly distinguish of the flower than the control Fig. (2).

On the other hand medium concentrate in from putrescine 200 ppm cleared a minimum days for appearance to the first flower, which was earlier than putrescine 100 by (8.24 and 8.03 days) for first and second seasons respectively, and showed earlier the appearance than putrescine 300 ppm by (13.9 and 14.28 days) for first and second seasons, respectively, also this treatments verified a decrease in the number of days for flowering than control by (20.16 and 21.75 days) below the control for the first and second seasons, respectively, from transplanting to days to the first flower.

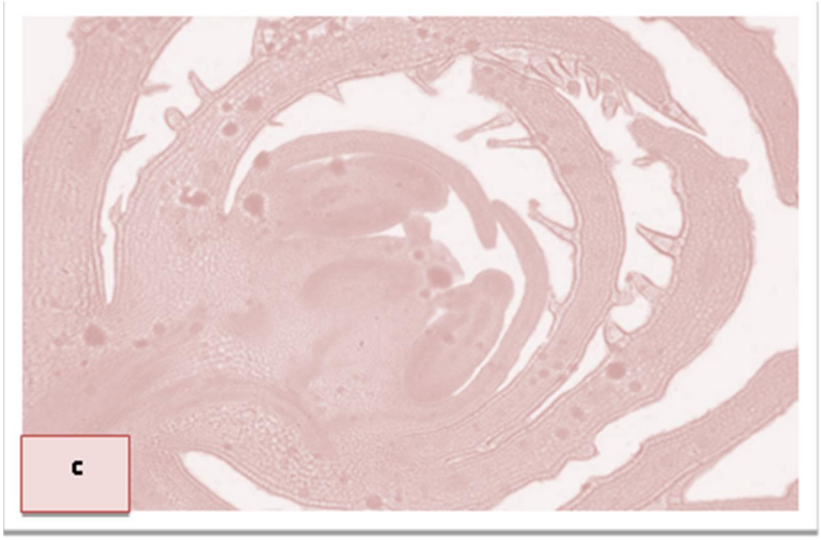
Last treatment with alpha-tocopherol exhibited similar trend as that of putrescine which cleared that at the medium concentration (800ppm) lower number of days to the first flower appearance than the other treatments alpha-tocopherol 400ppm by (5.12 and 5.62 days) for the first and second season respectively, and for alpha-tocopherol 1200 ppm by (10.24 and 11.49 days) for the first and second seasons, respectively, while the concentration 800ppm resulted in (14.37 and 16.25 days) for the first and second season, respectively, earlier than the control, and that logic where the flowering bud more distinguished as compared with the untreated plants Fig (2).



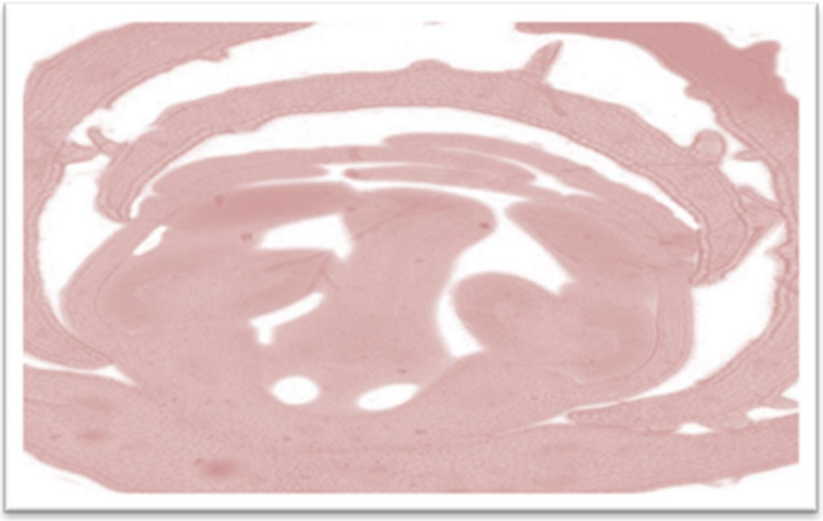
(a)-Untreated plants (control)



(b)- 10% diatomite



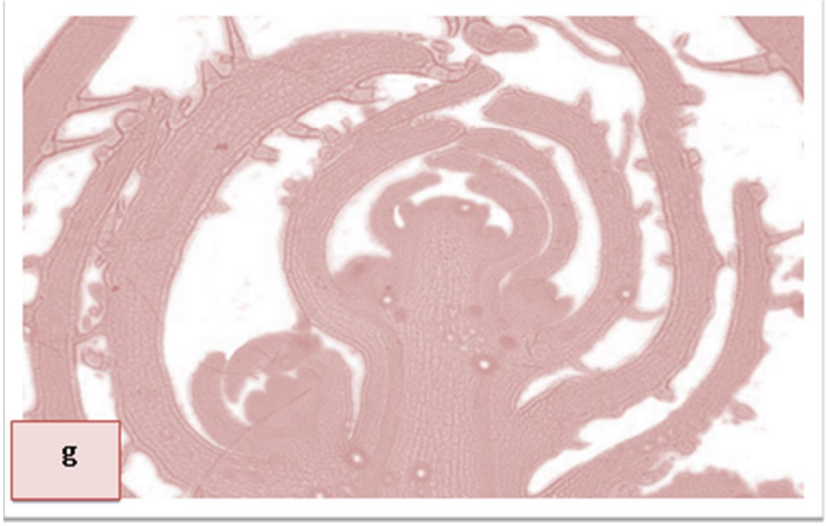
(c) -20% diatomite



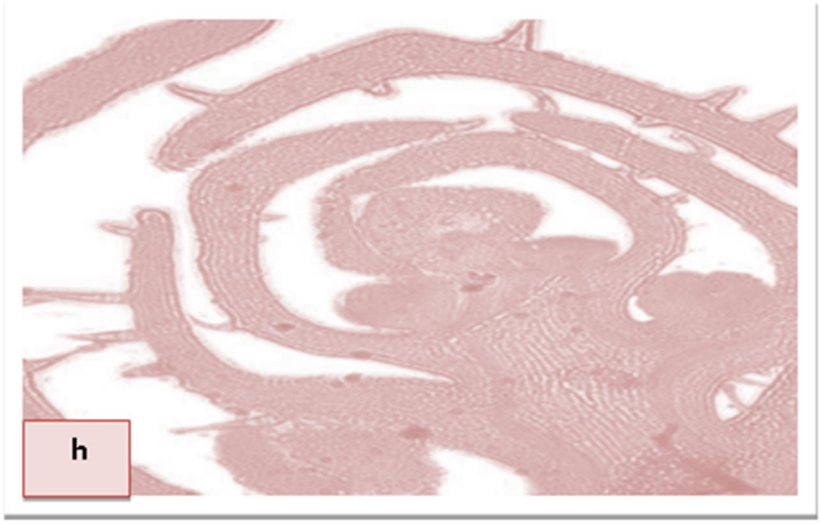
(d)- 30% diatomite

(e)- 100ppm putrescine

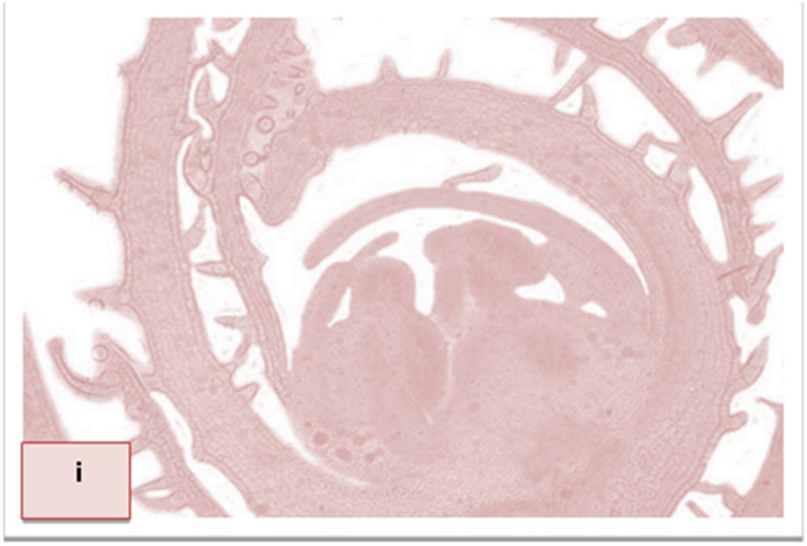
(f) 200ppm putrescine



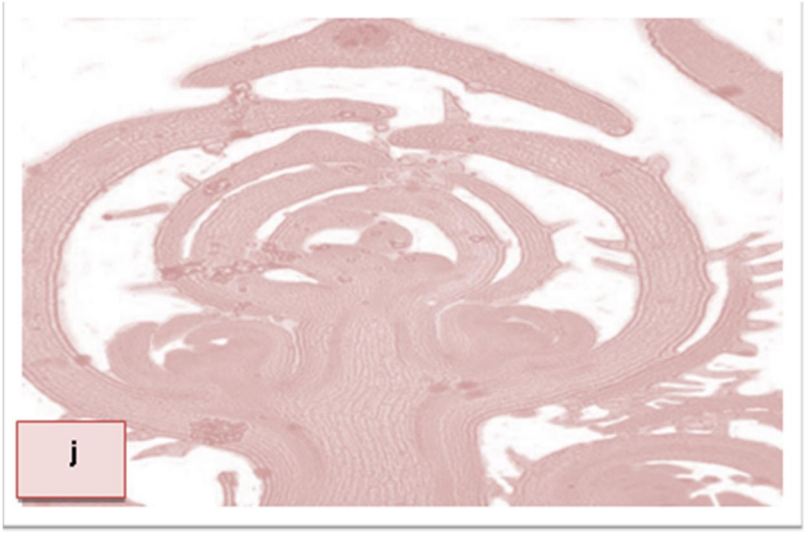
(g) 300ppm putrescine



(h) 400 ppm alpha tocopherol



(i) 800 ppm alpha tocopherol



(j)1200 ppm alpha tocopherol

Fig. 2: Transverse section of the bud in the eighth branch development on the main stem of *Antirrhinum majus* L. plant.

It's obvious from Fig.2 that different behavior for floral induction and differentiation in Antirrhinum was found. The developmental process of floral bud took place very rapidly at all treatments.

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