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Kinetin and Cycocel effects on vase life, flower stem anatomical structure and floral stem bending of Carnation plant Dianthus caryophyllus L.

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Abstract. This study was conducted at the department of horticulture –college of agriculture - Basrah university, to investigate the effect of kinetin at 0, 50 and 100 mg/l and/or cycocel at 0,1000 and 2000 mg/l on anatomical structure of flower stem of Carnation plant *Dianthus caryophyllus* L. in a factorial experiment designed with RCBD in the lath house. Plants of eight months old were spread with kinetin and/or treated with cycocel as a soil drainage and results showed that spraying with kinetin at 50 or 100 mg/l led to an increase in the number of cell rows and thickness in xylem and Phloem tissues, and reduced the flower stem bending in vase at both growing seasons. Adding 1000 or 2000mg ccc/l led to an increase in the previous indicators.

Keywords: carnation plant, growth substance, kinetin, cycocel.

Introduction

Carnations *Dianthus caryophyllus* L. are perennial herbaceous flowering plants belong to Caryophyllaceae family and widely used in garden design. And for their wide range formed flowers, they are considered to be one of the most popular cut flowers and commercially important in the world market ranking next only to rose, for their excellent keeping quality, ability to with stand long distance transportation and remarkable ability to rehydrate after continuous shipping.

Kinetin is a cytokinin which has been found essential for growth and development of plant organs, retention of chlorophyll, translocation of nutrients (Pandey and Sinha, 1984). On the other hand Langhans and Kumpf (1971) found that spraying carnation plants with cycocel at a concentration of 1000 or 2500 mg/l increased the stem hardness. While Radwan (1988) and El-Khayat (1987), in two studies on *Tagetes patula* and *Tagetes erecta* indicated that, spraying with kinetin at 50 mg/l resulted in an increase in fresh and dry weights of the flower stem. On the other hand Garrod and Harris (1974) found that treating carnations with kinetin increased the number of petals.

Abou-El-Ghait (1985) reported that spraying carnations with 100 mg/l of Benzyl Amino Purine BAP has increased the number and quality of flowers produced. While Sooch and Sooch (2002) in a twoyear study, found that spraying of kinetin at 100 mg/l led to an improve in vas life of carnation plant var. Corolla. The anatomical structure of *Dianthus caryophyllus* L. floral stem:

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The cross section of the flower stem consists of epidermis which is a single layer of cells in numerous sizes, of rectangle and oval forms surrounded with a thick layer of Cuticle.

After the epidermis inward comes Chlorenchyma region which consists of two rows of cells, followed by the cortex, which consists of several rows of Parenchyma cells characterized of different forms and sizes with clear intercellular spaces. The thickness of cortex is about 176.00 - 186.67 micrometers under a magnification force (X 10) and the rows number is 6.

Then comes a thick layer of Sclerenchyma cells, of about 133.34 - 160.00 micrometers in 7-8 rows then comes the Vascular bundle which consists of phloem of 42.67 micrometers thickness and the number of rows of cells is 8. Inward of phloem, xylem is located of 37.33 micrometers thickness and of 11cell rows.

The vascular bundles are cylindrical and consist of a continuous layer of circling xylem and phloem then comes a broad layer of Pith of about 32.00 - 42.67 micrometers thickness. The pith consists of Parenchyma cells of different sizes and forms contain intercellular spaces between them (plate 1).



Plate (1) The cross section of floral stem of Carnation Dianthus caryophyllus L. plant

Materials and Methods

The study was conducted at the faculty of agriculture - university of Basrah for the period from 15/9/2005 to 15/5/2007 to estimate the effect of kinetin at 0, 50 and 100 mg/l and/or cycocel at 0,1000 and 2000 mg/l on anatomical structure of floral stem of Carnation plant *Dianthus caryophyllus* L. in a factorial experiment designed with RCBD in the lath house.

Homogenous eight-month-old plants grown in 25 cm pots were brought from Baghdad and transplanted to a 35 cm pots. and plants were treated with kinetin and/or cycocel on the 1st of October at autumn season and the 1st of march at spring. Data was tabulated on vase life and flower stem bending in vase. Nine flowers were harvested at full opening stage, they were taken randomly from each treatment early in the morning then, the length of the floral stems was limited to 25 cm (Iordachescu and Verlinden, 2005). These flowers were placed directly in clean, sterile glass containers filled with tap water to the bottom of the upper pair of leaves.

Percentage of the bending floral stems in vase for each treatment was calculated as follows:

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Number of flowers with bending stems in vase

% bending floral stems = ------ X100

Total number of flowers in that treatment

Anatomical study: Three flowers were randomly picked and three samples of each stem was taken as cross sections, the first area was located in the middle of the stem and the other two were located three centimeters above and below the middle. The histological sections were used using paraffin wax (Drury *et. al.*, 1967).

The anatomical study was conducted in the laboratories of the Department of biology - Faculty of Science / University of Basrah.

The experiment was carried out using a randomized complete block design in a factorial arrangement and The obtained data were analyzed through analysis of variance procedure using the Statistical Package for Social Sciences computer program (11.0) Means were compared by R.L.S.D. test (P 0.05).

Results and Discussion

Data tabulated in table (1) shows that spraying carnation plant with kinetin at 100 mg/l in addition to a 2000 mg/l cycocel treatment gave the highest significant values of vase life 8.81 and 6.92 days during autumn and spring seasons, respectively. while the lowest values of vase life during the previous two seasons were 4.26 and 4.02 days, respectively.

were resulted in control plants.

| Kinetin con. mg/l. | Cycocel con. mg/l | Spring | Autumn |
|-----------------------|----------------------|--------|--------|
| 0 | õ | 4.02 | 4.26 |
| 0 | 1000 | 4.89 | 5.42 |
| | 2000 | 5.22 | 6.65 |
| | 0 | 4.41 | 5.43 |
| 50 | 1000 | 5.01 | 6.82 |
| | 2000 | 6.12 | 7.89 |
| | 0 | 5.13 | 6.80 |
| 100 | 1000 | 6.12 | 7.26 |
| | 2000 | 6.92 | 8.81 |
| RL | $SD_{(0.05)}$ | 0.204 | 0.220 |

 Table (1): Effect of Kinetin and cycocel on vase life (day)

 Carnation Dianthus caryophyllus L. plant

Many researchers have conducted studies on the effect of cytokineins in delaying the aging of flowers by adding them to conservation solutions in cut flower pots, with certain results (Mayak and Halevy, 1970; Mayak and Dilley, 1976; Mayak and Kofranek, 1976; Wareing and Phillips, 1981; Chen, *et al.*, 2001). Wawrzynczak and Goszczynska (2003) and (2004) indicated that the addition of kinein and/or benzyl adenine to vases prolongs life of cut carnation.

Plate (2) and (3) and table (2) and (3) show that the number of rows of xylem and phloem increased as a result of treating with kinetin or cycocel. Spraying carnation plants with 100 mg/l of kinetin with and cycocel at 1000 mg/l has significantly increased the number of phloem and xylem rows and thicknesses. The xylem rows were 5-11 with an average of 8.3 and the thickness was 106.4 -308.5 micrometers at a rate of 207.4 micrometers. While number of rows of phloem cells ranged from 8-14 rows at a rate of 10.7 rows and thickness of 31.9 - 85.1 micrometers and a rate of 58.5 micrometers. The number of vascular bundles in the stem of control plants was less, the number of rows of xylem was 2-4 rows with a rate of 3.8 rows and xylem tissue thickness 32.0-48.0 micrometers and 40 micrometers, and the number of rows of phloem between 3-7 rows and the rate of 4.7 rows and thickness was 21.3 - 32.0 Micrometer at the leverage of 19.7 micrometers.

| Kinetin Con. mg/l. | Cycocel Con. mg/l | Xylem rows No. | Phloem rows No. |
|-----------------------|----------------------|-------------------|--------------------|
| | 0 | 3.8 | 4.7 |
| 0 | 1000 | 4.3 | 5.4 |
| | 2000 | 4.6 | 6.0 |
| | 0 | 7.1 | 6.0 |
| 50 | 1000 | 4.9 | 6.7 |
| | 2000 | 8.3 | 10.7 |
| | 0 | 5.1 | 5.7 |
| 100 | 1000 | 6.2 | 6.7 |
| | 2000 | 6.3 | 8.1 |
| RL | SD _(0.05) | 0.387 | 0.416 |

Table (2): Effect of Kinetin and cycocel on number of xylem and phloem rows in the cross section of the floral stem of Carnation plant *Dianthus caryophyllus* L.

Table (3): Effect of Kinetin and cycocel on xylem and phloem thickness (µm) in the cross section of the floral stem of Carnation plant *Dianthus caryophyllus* L.

| Kinetin con. mg/l. | Cycocel con. mg/l | Xylem thickness | Phloem thickness |
|-----------------------|----------------------|--------------------|------------------|
| 0 | Ō | 40.0 | 19.0 |
| | 1000 | 74.8 | 43.0 |
| | 2000 | 84.2 | 42.9 |
| | 0 | 194.0 | 44.2 |
| 50 | 1000 | 86.3 | 46.6 |
| | 2000 | 207.0 | 58.0 |
| | 0 | 97.9 | 43.4 |
| 100 | 1000 | 120.6 | 45.3 |
| | 2000 | 190.9 | 48.5 |
| RL | $SD_{(0.05)}$ | 3.902 | 4.120 |



Plate (2) Anatomical structure of the floral stem of carnation *Dianthus caryophyllus* L. plant when treated with 100 mg/l kinetin + 1000 mg/l cycocel) X 10(, Ph : Phloem, Xy: Xylem , Sc:Sclerenchyma Ch :Chlorenchyma, Pi : Pith,



Plate (3) Anatomical structure of the floral stem of carnation *Dianthus caryophyllus* L. in control plants Pi : Pith (X 10) : Xylem, Phloem, Xy :Ph

It is evident in table (4) that percentage of the bending floral stems in vase was affected in plants treated with kinetin and cycocel during autumn and spring seasons. This percentage was decreased significantly in plant treated with kinetin at 100 mg/l and cycocel at 1000 mg/l and recorded 22.86 and 25.44% during the autumn and spring seasons, respectively. On the other hand, the highest percentage of bended stems was 64.62% and 66.39% during the previous two seasons, respectively. was at control plants.

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These results due to the increase in the number of vascular bundles, the increase in the diameter of vascular vessels and the increase in their density as compared to control plants which gave the highest

percentage of bended floral stems in vase.

Treating carnation plants with kinetin at 100 mg/l accompanied by the addition of cycocel at 1000 mg/l increased the number of xylem rows to 5-11 (average =8.3). On the other hand xylem thickness was 106.4 - 308.5 micrometers, while the phloem cell rows number was 8-14 (at an average 10.7) and of 31.9- 85.1 μ m thickness (average = 58.5 μ m).

In control plants, the number of xylem rows 2-4 with an average of 3.8 rows and xylem thickness recorded 32-48 μ m and an average of 40 μ m, also the number of phloem rows was 3-7 row (average =4.7)and thickness of 21.3 - 32 μ m and 19.7 μ m average.

Similar results have also been obtained by Rasmussen and Carpenter (1974) noting that the number of vascular bundles in floral stem was few in bounded flower stems and increased in non-bounded ones.

| Kinetin con. mg/l. | Cycocel con. mg/l | Spring | Autumn |
|-----------------------|----------------------|--------|--------|
| | 0 | 66.4 | 64.6 |
| 0 | 1000 | 39.8 | 25.3 |
| | 2000 | 25.4 | 22.9 |
| | 0 | 58.3 | 50.4 |
| 50 | 1000 | 46.4 | 42.2 |
| | 2000 | 40.6 | 34.7 |
| | 0 | 60.1 | 45.6 |
| 100 | 1000 | 40.9 | 38.7 |
| | 2000 | 33.2 | 30.0 |
| RL | $SD_{(0.05)}$ | 23.22 | 3.140 |

| Table (4): Effect of Kinetin and cyce | ocel on the bended floral stems in |
|---------------------------------------|------------------------------------|
| vase (%) of Carnation Diant | thus caryophyllus L. plant |

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