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POSTHARVEST STUDIES ON THE CUT FLOWERS OF DAHLIA (*Dahlia hybrida* L.):
I: EFFECTS OF PREVENTING LATEX FLOW, PULSING, AND HOLDING SOLUTIONS ON FLOWER WATER RELATIONS AND THE ANATOMICAL STRUCTURE OF THE FLOWER STEM.

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ABSTRACT

Once the cut flowers of dahlia (*Dahlia hybrida* L.) Fam. Asteraceae are cut from the plant, a milky sap called latex fuses out of the flower stem base and plugs the conducting vessels at the cut surface of the base of the flower stem. This reduces water uptake; causing a rapid wilting of the flower and short vase life. A comprehensive postharvest study on dahlia cut flowers was carried out during the two successive seasons of 1995/1996 and 1996/1997, at the Veget. and Flor. Dept., Fac. of Agric., Mansoura Univ. to evaluate the effects of three stepwise postharvest treatments (and their combinations) on vase life and quality of cut dahlia flowers. These treatments were: to overcome the latex problem (untreated control, dipping in ethanol solution, searing over a flame, and dipping in boiling water), followed by short term pulsing treatments (silver thiosulfate (STS), an antibiotic complex, and 8-hydroxyquinoline sulfate (8-HQS)). In the final step, different components of the flower holding solutions (sucrose, boric acid, citric acid, and cycocel (CCC)) were evaluated.

In this part (I), the effects of these treatments on water relations and anatomical changes of the internal structure of the base of the stem of the cut flower were evaluated.

The results revealed that placing the base (5 cm) of the stem in ethanol (95%) was the best method to prevent latex problem leading to the highest water uptake and maintenance of fresh weight of the flower at high values for a longer period than searing or boiling treatments. Pulsing the cut flowers with 4 mM silver thiosulfate (STS) for 10 minutes minimized bacterial growth and led to the highest solution uptake and maintained fresh weight of the cut flower at high values. Although citric acid (10 ppm) had the lowest pH value which led to reduced bacterial growth and had the highest solution uptake, sucrose (1.5%) maintained the fresh weight of the cut flower at higher values for a longer period compared with all other holding solutions. Boric acid and Cycocel resulted in intermediate water uptake.

The anatomical study showed numerous scattered laticifer vessels in the cortex tissue at the outer periphery of vascular bundles and also in the pith tissue. After five days from treatment, the untreated (control) flowers showed the formation of tyloses in the narrow xylem vessels. The cells of the cortex and pith tissues showed severe plasmolysis, followed by hydrolysis or dissolution of cell components, and the stem had macerated and fractionated vascular tissues. Flowers received ethanol treatment maintained their anatomical structure; wide xylem vessels without tyloses, and the cortex and pith parenchyma cells were fully turgid and intact. In case of flowers that received searing treatment, the basal part of the stem became brown, and cortex tissues and the xylem vessels were damaged. Flowers which received boiling water treatment showed hydrolysis and dissolution of cell components, degradation of secondary wall thickening in some xylem vessels, and the cortex tissue gelatinized.

INTRODUCTION

The cut flowers of dahlia (*Dahlia hybrida*, L) Fam. Asteraceae have established themselves as favorites around the world. Short vase life of flowers could be one of the most important reasons for the inability of florists to develop any appreciable market. The cut flowers of dahlia tend to have a very short vase life, which reduces their potential as a commercial cut flower Dahlia plant contain laticifers; which are cells or series of fused cells containing a milky sap called latex and forming systems that permeate various tissues of the plant body. In the intact plant the laticifers are under turgor, and release the latex when they are cut open. Once dahlia flowers are cut from the plant, latex fuses out of the flower stem plugging the conducting vessels at the cut base of the flower stem, and prevents water uptake causing a rapid wilting of the flower.

The laticifers were interpreted as elements morphologically distinct from the sieve tubes, but related to secretary structures (Bonner and Galston, 1947). Two types of laticiferous ducts were found, latex vessels and latex cells (Hill and Popp, 1950).

Through the years, many methods to condition cut flowers, which exude latex, have been investigated. These methods included searing the base of the stem over a flame or steam, dipping the stem in a boiling water, and pulsing in alcohol (Gordon et al., 1986; Halevy and Mayak, 1981; Rogers, 1963 and1973).

The termination of the vase life of many cut flowers is characterized by wilting, even though they are held constantly in water. Rapid wilting is one of the main reasons that reduced the useful vase life of the cut flowers. Plugging of the conductive tissues within the stem of the cut flower is a main reason for reduced water uptake and transport (Durkin et al, 2001; Van-Doorn and Perik, 1990; Van-Doorn and Reid, 1995).

In this work, three stepwise postharvest procedures were conducted on cut dahlia in order to prolong and to improve its useful vase life. In the first step, treatments to overcome the latex problem (searing, dipping in boiling water, and dipping in ethanol solution) were used, followed by short term pulsing treatments to overcome growth of microorganisms and/or to antagonize ethylene (silver thiosulfate complex (STS), an antibiotic complex, and 8-hydroxyquinoline sulfate (8-HQS)). In the final step, different components of the flower holding solutions (sucrose, boric acid, citric acid, and cycocel (CCC)) were evaluated.

In this part (Part I), the effect of these treatments on water relations were evaluated, in addition to study the effects of ethanol, searing, and boiling water treatments on the internal structure of the flower stem.

MATERIALS AND METHODS

The present investigation was performed during the two successive seasons of 1995/1996 and 1996/1997 at the Experimental Station, Faculty of Agriculture, Mansoura University. Dahlia tuberous (*Dahlia hybrida* cv. Small Decorative) were planted on September 15th in both seasons. Plot size was

(length x width) 6 m x 8 m = 48 m^2 with 6 rows 1m apart. Plant spacing was done at 80 cm. Number of replications was 4 replicates. Standard cultural practices were performed as usual for dahlia plants.

Postharvest treatments: Dahlia plants flowered during spring of 1996 and 1997. Flowers were cut when they were semi-open (just beginning to open and showing about one cm of ray florets). Flowers were cut early in the morning and immediately brought to the laboratory where they were graded according to size of flower and length of stem flower. Upon arrival to the laboratory, the flower stem was re-cut in air, removing about 3cm from the base and the fresh weight of the flower was recorded before treatments.

I. First step (main treatments) for preventing latex flow:

Flowers were divided into four groups:

1. Untreated flowers
2. Ethanol treatment: the lower 5 cm from the base of the flower stem was placed in 95% ethanol for 5 min.
3. Searing treatment: the cut end of the flower was seared on a flame for 15 sec.
4. Boiling water treatment: the lower 5 cm from the cut end of the flower stem was held for 1 min.

II. Second step (sub-treatments) for pulsing flowers:

Each group of the previously mentioned four groups was divided into the following three groups:

1. Silver thiosulfate (STS) treatment: Silver thiosulfate (STS) solution was freshly prepared according to Reid et al., 1980, and the flowers were placed in 4mM STS solution for 10 min.
2. 8-hydroxyquinoline sulfate (8-HQS) treatment: Flowers were placed in 400 ppm 8-HQS solution for 10 min.
3. Antibiotic treatment: Flowers were placed in an antibiotic complex (150 ppm tetracycline hydrochloride and 50 ppm streptomycin (sulfate) U.S.P.16) for 10 min.

III. Third step (sub-sub-treatments) for holding solutions:

The previously mentioned two steps ended with 12 groups; each group of them was divided into another five groups of solutions and flowers were placed in them until the end of the experiment as follows:

1. Distilled water (DW).
2. Sucrose solution (1.5%).
3. Boric acid solution (10 ppm).
4. Citric acid solution (10 ppm).
5. Cycocel (CCC) solution: flowers were dipped in 200 ppm CCC solution for 24 hours, then placed in DI water.

N.B. All solutions were prepared using distilled water (DW).

The tested flowers were placed individually in 100 ml graduated cylinder filled with designated holding solutions and left in the laboratory conditions at 23°C and 60-70% relative humidity. Additional ten graduated

cylinders filled with water only were added to the whole experiment and placed in the laboratory under the same conditions, in order to measure the average daily evaporation value. The useful vase life of each inflorescence was terminated when it lost 10% of its maximum fresh weight, the ray florets wilted, or when shattering of the corolla and/or petal scorch (browning of the petal edge) occurred.

Measurements:

The following data were recorded:

1. **pH of the holding solution:**

at the beginning of the experiment and at the end of the vase life of the flower.

2. **Averages of bacterial counts (colonies/ml):**

Two days after placement of the flower in the holding solution, bacterial contamination was determined as the average number of bacterial colonies in 1 ml of the holding solution as described by Marousky (1969). The experiment was repeated two times with 4 petri dishes in each treatment.

Daily solution uptake (ml/flower/day):

Daily solution uptake for each flower was recorded as the daily decrease in the solution level of the graduated cylinder after subtracting the average daily evaporation value.

4. Daily fresh weight:

The initial fresh weight was recorded immediately after cutting the flower. Every 24 hrs, each flower was weighed in order to estimate the average daily change in fresh weight (g/flower/day).

Statistical analysis:

A split-split plot design with 4 replicates/treatment was followed. Each replicate contained 10 individual flowers. The main plot was the treatments used to control latex flow, and the sub-plot was the pulsing treatments, while the sub-sub-plot was the holding solution treatments. Treatment differences were determined by analysis of variance procedure as mentioned by Gomez and Gomez (1984). Computation was done using SAS computer software program (SAS Institute, 1985). Treatment means were compared using the least significant difference test (LSD), (probability 5 %).

Anatomical studies:

The anatomical studies were carried out during the second season. Stem segments (5-9 mm in length) were taken from the base of the stem for each treatment. The control sample was taken at the beginning of the experiment before treatments. Five days after treatments, stem samples from the control and the three preventing latex flow treatments were taken in order to evaluate the effect of each treatment on the vascular anatomy of the stem base. The sample segments were immediately killed and fixed in FAA solution (85 ml of 50% ethyl alcohol, 10 ml formalin, and 5 ml glacial acetic

acid) Samples were dehydrated in ethanol alcohol series, cleared by xylene and embedded in paraffin wax (55-58 °C - m.p.). Cross and longitudinal sections 15-20 um were prepared using rotary microtome, stained with saffranin-light green combination, cleared in oil cloves and mounted in Canada balsam (Johansen, 1940) for microscopic examination and photography.

RESULTS AND DISCUSSION

1. Water Relation study:

A. The pH values of different treatments:

The data in Table (1) represented the pH (as an average of 1996 and 1997 seasons) of different treatments at the beginning of the experiment and at the end of the vase life. Citric acid (10 ppm) as a holding solution had the lowest pH values, while distilled water or sucrose (1.5%) solutions had the highest ones. It is interesting to note that citric acid treatment (10 ppm) as holding solution was lower when the pH started, while, it increased at the end of the experiment. This might be caused by a flow of alkaloid substances from the stem of the cut flower to the preservative solutions.

Most preservative formulations contained an acid to reduce the pH of water to 3-4 (Rogers, 1973; Abdel-Kader and Rogers, 1986). Low pH reduced physiological plugging (Durkin, 1979), and microbial growth (Abdel-Kader, 1987) and improved water uptake by flowers.

B. Effect of different treatments on growth of bacteria:

Inclusion of a high number of bacteria in the vase solution was found to reduce the longevity of cut flowers. Bacteria apparently led to physical xylem occlusion, which resulted in a decrease of water uptake and a low water potential (Van-Doorn and Reid, 1995). Bacteria also induce physiological plugging indirectly by the release toxic metabolites and/or enzymes into the holding water (Van-Doorn and Perik, 1990). Some bacteria were also reported to produce ethylene that causes rapid aging of the cut flowers (Fujino et al, 1983).

The results in Table (1) indicated that preventing latex flow treatments significantly decreased the average bacterial counts in the solution (colonies/ ml) in 1997 season. The lowest bacterial count was achieved using ethanol (95 %) treatment compared with the control and other treatments, while the highest was found in the untreated control. In this line, Sykes (1965) stated that alcohols are protein denaturants, and this property might be accounted for their antimicrobial activity.

The Table also showed that pulsing flowers in STS produced the lowest average of bacterial colonies, while 8-HQS ranked second, and the antibiotic complex was third. Relevant averages were 442.2, 461.5 and 483.4 colonies/ml, respectively Silver salts are very effective anti-microbial agents (Halevy and Mayak, 1981). Thus, the amount of silver ion adsorbed on the cut end of stem would prevent the entry and proliferation of bacteria into the conductive tissues.

Maximum average of bacterial count was recorded when distilled water was used as a holding solution (499.6 colonies/ml), followed by sucrose solution (470 colonies/ml). Citric acid on the other hand, resulted in the lowest bacterial growth (430.3 colonies/ml). Citric acid reduced bacterial growth by lowering the pH of the solution (see pH), as demonstrated by Durkin et al. (2001), who reported that citrate-phosphate buffer at pH 3 reduced microparticles and bacterial cell adherence in the holding solution of roses.

Table (1). Initial and final pH values of different solutions, average bacterial count, and solution uptake by dahlia flower as affected by the three stepwise postharvest treatments.

Treatments	Measurements				
	pH of the vase solution (1997)		Average bacterial count (Colonies/ml)	Solution uptake (ml/flower)	
	Initial	Final	1997	1996	1997
A. First step : Preventing latex flow					
Control	5.6	5.7	521.5	6.21	6.75
ethanol (95%)	5.1	5.1	420.3	10.26	10.74
Searing	5.3	5.4	439.3	9.21	9.75
Boiling water	5.4	5.6	468.4	7.24	7.77
L.S.D. 5%	-----	------	--------	0.3	0.1
B. Second step: Pulsing treatments					
STS	5.2	5.3	442.2	9.22	9.75
8-HQS	5.3	5.4	461.5	8.23	8.79
Antibiotic complex	5.5	5.6	483.4	7.24	7.72
L.S.D. 5%	-----	-----	-------	0.08	0.05
C. Third step : Holding solutions					
Distilled water	6.4	6.5	499.6	7.76	8.24
Sucrose (1.5%)	6.4	6.5	470.0	7.18	7.74
Boric acid (10 ppm)	5.6	5.4	449.2	8.24	8.75
Citric acid (10ppm)	3.9	5.0	430.3	9.24	9.8
Cycocel (200 ppm)	5.5	5.4	462.8	8.74	9.24
L.S.D. (5%)	------	-----	--------	0.23	0.28
Interaction (F-Test)					
AxB				N.S.	N.S.
AxC				N.S.	N.S.
BxC				N.S.	N.S.
AxBxC				N.S.	N.S.

C. Effect of different treatments on the average water uptake (ml/flower):

Treatments that prevented latex flow significantly increased water uptake of dahlia flowers in both seasons compared with the untreated control (Table, 1). Treatment with ethanol (95%) had the highest water uptake 10.26 and 10.74 ml / flower in the first and second season, respectively. The lowest water uptake value was recorded when latex flow was not prevented (6.21 and 6.75 ml/flower). Pre-treatments which coagulate the latex, e.g., dipping

the cut base in alcohol, searing the base of the stem over a flame or steam or holding the stem in a boiling water were recommended by Rogers, (1963) The increases in water uptake due to using ethanol (95 %) might be attributed to the effect of alcohol in dissolving the latex at the end of stem base and subsequently allowing more water uptake by the cut flower. The latex contains glycosides, alkaloids, and lipids which are usually soluble in organic solvents, such as chloroform, ether or lower alcohol's (Balbaa *et al.*, 1976). It could be suggested that the searing and boiling treatments denatured protein components and might deteriorate other components of latex compound.

The highest water uptake by dahlia cut flowers was of those pulsed with STS solution, compared with 8-HQS and antibiotic complex. Relevant values of ethanol treatment were 9.22 and 9.75 ml/flower in the first and second season, respectively. In this respect, Mayak *et al.* (1974) stated that growth of microorganisms in the holding solution and in the flower stems is considered as a prime reason for reduced water uptake and early wilting of the cut flowers. It is very likely that the increased water uptake as a result of pulsing treatments is related to reducing bacterial growth as previously mentioned. STS also preserves cell membrane integrity and maintains favorable water balance within the cut flower by antagonizing ethylene action (Hiraya *et al.*, 2002).

The results of Table (1) also indicated that using citric acid (10 ppm) significantly increased the water uptake per flower compared with other treatments. The corresponding data were 9.24 and 9.8 ml / flower in the first and second seasons, respectively. Similarly, Abdel-Kader and Rogers (1986) showed that solution uptake by cut gerbera was increased by adding citrate-phosphate buffer to lower the pH of the holding solution. Many preservative solutions contain an acid to reduce the pH. Durkin et al (2001) showed that citric acid reduced pH and bacterial growth in the holding solution of cut roses. On the other hand, using sucrose (1.5 %) significantly reduced water uptake per flower compared with other treatments. Relevant values were 7.18 and 7.74 ml / flower in the first and second seasons, respectively.

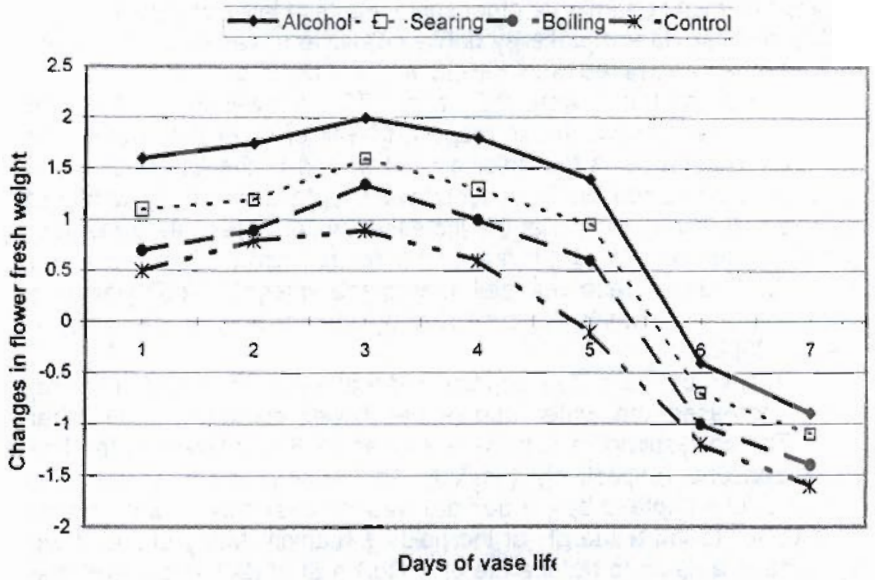
D. Effect of different treatments on changes in fresh weight (g/ flower / day):

The termination of vase-life of many cut flowers is characterized by wilting, even though they are constantly held in water. The components of water balance are water uptake and transport, water loss, and the capacity of the flower tissue to retain its water (Halevy and Mayak, 1981). After flowers are cut and placed in water, they exhibit changes in fresh weight. Flower turgidity is the result of the balance between the rate of water uptake and water loss, and gains in fresh weight can occur only when the rate of water uptake is greater than the transpiration. The negative or positive change in fresh weight of the flower reflects the overall water balance within the cut flower.

Typically, cut flowers initially increase and subsequently decrease in fresh weight (Rogers, 1973). In this experiment, weight changes followed the same trend (as shown in Fig. 1), but superiority of ethanol treatment was obvious. Dahlia flowers that were treated with ethanol (95 %) had better fresh

weight values, compared with searing, boiling and the check treatment. Dipping in ethanol (95 %) improved water uptake by dissolving the latex, and, thus increased water flow through dahlia stem sections. Ethanol also affected microorganisms' population in the solution as previously mentioned.

Figure 1: Daily changes in flower fresh weight during vase life of cut Dahlia as affected by treatments used to prevent latex flow.



The effect of pulsing treatments on changes in fresh weight (g / flower/day) of dahlia flowers during vase-life was graphically demonstrated in Figure (2). In these treatments, the weight gain during the vase period was highest when dahlia cut flowers were pulsed in STS or 8-HQS solutions as compared with flowers that were pulsed in an antibiotic solution. The role of STS in increasing water uptake was previously discussed.

With respect to holding solutions treatments, Figure (3) showed that weight change values were decreased with age in all the treated flowers. Sucrose (1.5 %) and critic acid (10 ppm) surpassed all other treatments (boric acid 10 ppm, cycocel 200 ppm and control) as weight gain was concerned. A similar trend was reported by Marousky (1969), who showed that roses held in sucrose-containing solutions absorbed less water than roses held in water alone, but sustained their fresh weight increases for a longer time.

Sugars have a role in controlling water balance within the cut flowers. The translocated sugars accumulate in the flower and increase osmotic concentration leading to improve their ability to absorb water and maintain their turgidity (Halevy 1976). In addition, sugars cause partial stomatal closure and; thus, reduces water loss.

Figure 2: Daily changes in flower fresh weight during vase life of cut Dahlia as affected by pulsing treatments.

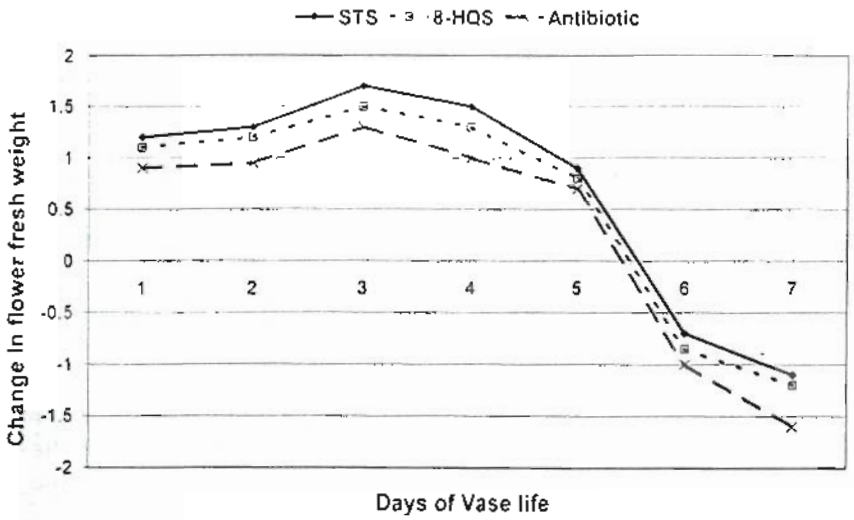
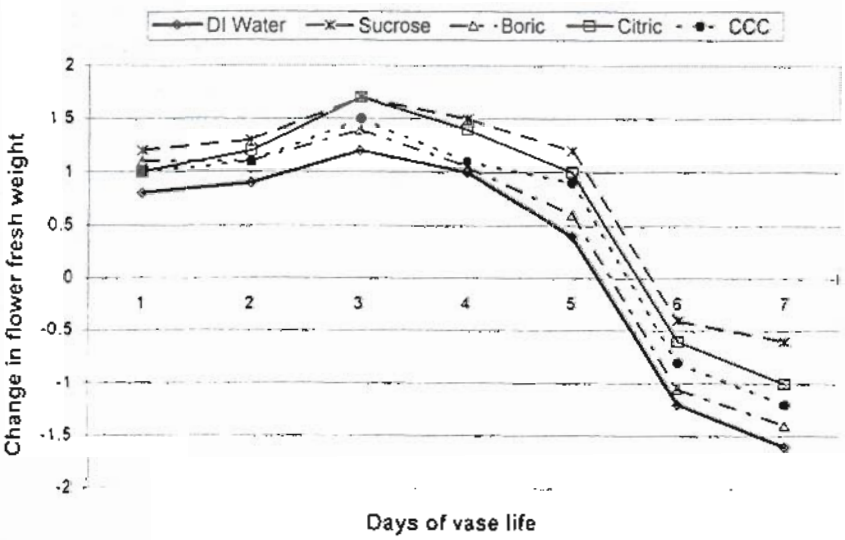


Figure 3: Daily changes in flower fresh welght during vase life of cut Dahlia as affected by the holding solutions.



2. Anatomical Study:

A. Anatomical structure of the stem

Control samples were taken at the dav of harvest from the stem of dahlia cut flowers and were used as a control. In general, the stem anatomy resembles the description of dicotyledonous stem written by Fahn (1990). The general structure of the stem was shown in Figures (4&5). It is also clear that numerous scattered articulated laticiferous vessels occur in the cortex tissue at the outer periphery of vascular bundles and also occur in the phloem and pith tissues (Figure, 4). Laticifers contain latex as a suspension or emulsion white and mikly liquid. Laticifers release the latex by a pressure flow when the inflorescences are cut.

The stem structure of dahlia stem in a longitudinal section (L.S.) through the basal part of the stem at the cut inflorescence (Fig. 5) showed that the xylem vessels are lignified with spiral, scalariform and reticulate secondary thickenings. The laticifer vessels appear as a series of fused cells, which are usually elongated and are bigger than the neighboring parenchyma cells. It is also obvious that the tissues of the control sample are intact.

B. Comparison between treatments:

In order to study the anatomical changes during senescence in the stem at the cut inflorescence, cross and longitudinal sections through the basal part of the stem were taken after 5 days from the beginning of the experiment.

1. Effect of the untreated control (distilled water):

After 5 days from the beginning of the experiment, sections taken from the stem at the cut inflorescence that were held in the distilled water without receiving any treatment (Figures 6&7). The transverse section (Fig., 6) clearly showed the formation of tyloses in the xylem vessels and narrow xylem vessels. Similarly, Morris (1964) reported that the restricted water uptake was probably associated with formation of tyloses in xylem vessels as well as narrow xylem vessels. Microscopic examination of cut rose stems performed by Lineberger and Steponkus (1976) revealed vascular occlusions due to microbial growth and gum deposition. However, Rasmussen and Carpenter (1974) reported several types of occlusions and changes in the vascular morphology during senescence of cut rose stems. The cortex and pith tissues showed severe plasmolysis of the cells, followed by hydrolysis or dissolution of cell components and degradation of the primary cell walls. Finally, the separated cells became dead and gelatinous, the stem macerated and fraction of vascular tissues took place (Fig., 7). Ethylene promoted the activity of exo- and endo-cellular hydrolytic enzymes (Huberman and Goren, 1979).

Fig. 4: Cross section through the basal part of the stem of dahlia cut inflorescence at the day of harvest. Note numerous scattered laticiferous vessels (L) in the cortex (CO) and pith tissue (Pi). [Obj. 10 x - Oc. 10 x]. X: xylem, Ph: phloem, Phf: phloem fibers.

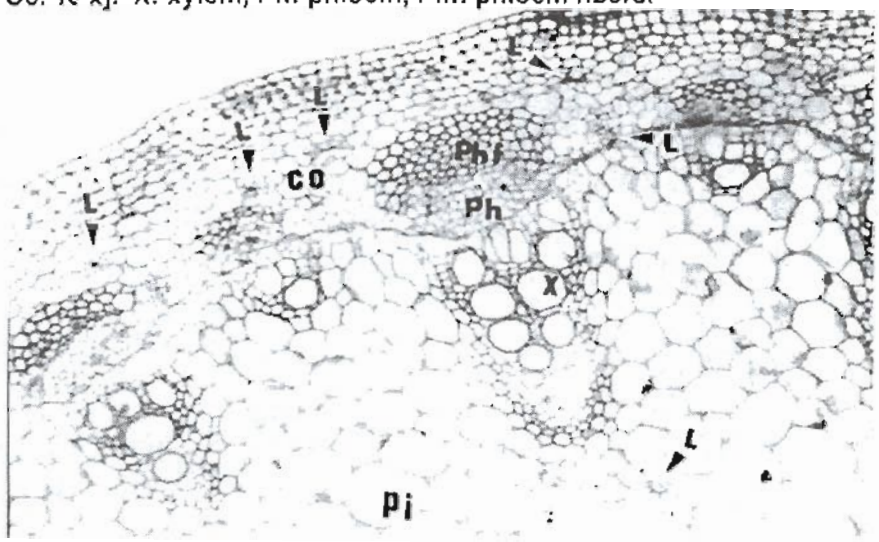


Fig. 5: Longitudinal section through the basal part of the stem of dahlia cut inflorescence at the day of harvest showing that the tissues are intact. The xylem vessels (XV) had spiral, scalariform and reticulate secondary thickening. [Obj. 10 x - Oc. 10 x]. L: Laticiferous vessels, C: Cortex.

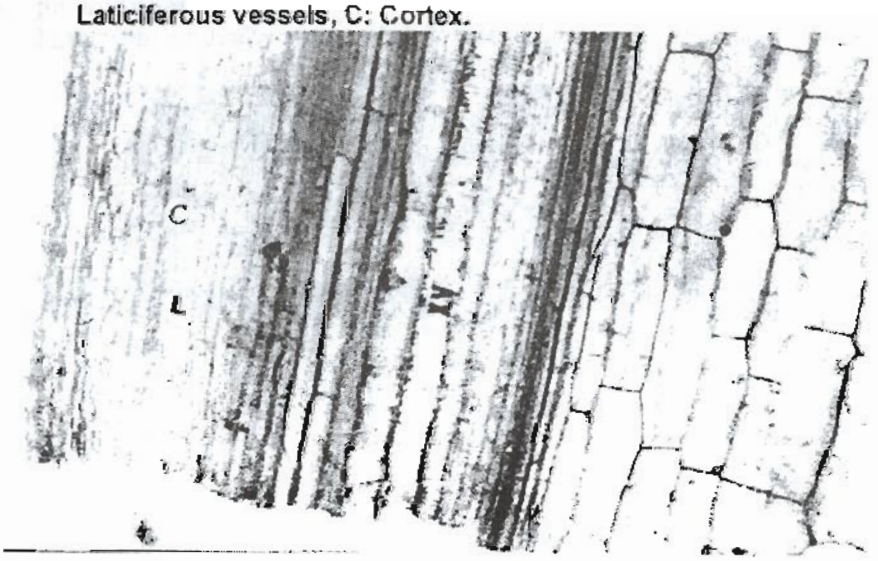


Fig. 6: Cross section through the basal part of the stem of the cut inflorescence after 5 days after placing in distilled water showing the formation of tyloses (T) in the xylem vessels (XV), narrow xylem vessels. [Obj. 10 x - Oc. 10 x]. CO= Cortex, Pi= Pith.

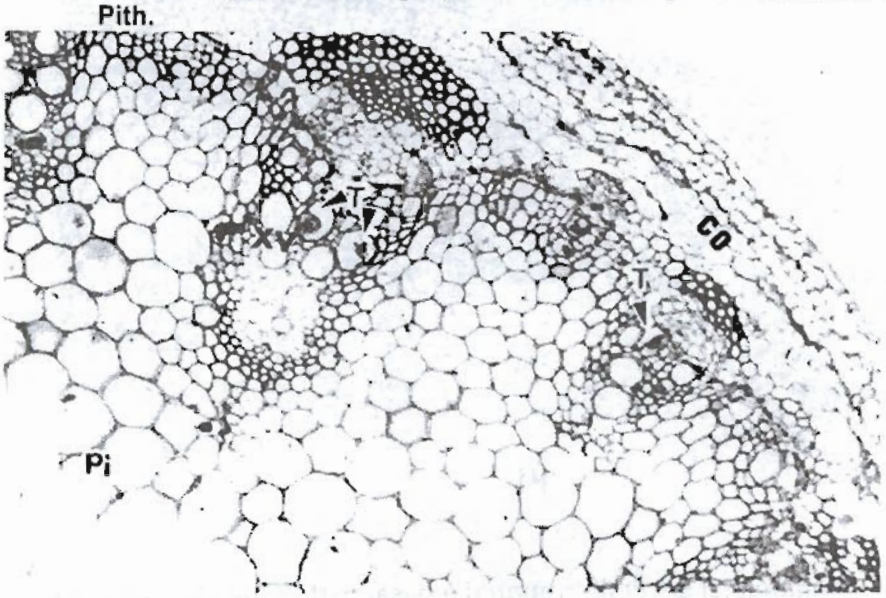
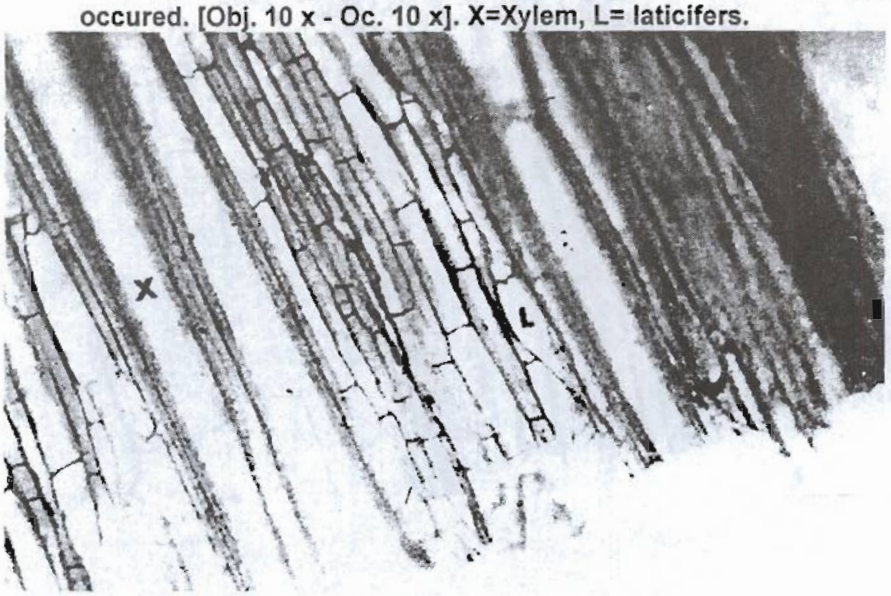


Fig. 7: Longitudinal section through the basal part of the stem of the cut inflorescence 5 days after placing in the distilled water showing that the stem macerated and fraction of vascular elements occured. [Obj. 10 x - Oc. 10 x]. X=Xylem, L= laticifers.



2. Effect of preventing latex flow treatments:

The anatomical changes occurring in the basal part of the stem after postharvest treatments i.e. pulsing the stem ends either in 95 % ethanol for 5 minutes, searing the stem ends or dipping the stem ends in boiling water followed by holding solutions are shown as follows:

2.1. Effect of ethanol on the anatomical structure.

Figures 5 and 6 showed cross and longitudinal sections through the basal part of the stem ends, which were pulsed in ethanol (95 %) for 5 minutes followed by placing in STS then 1.5 % sucrose, after five days of the treatment. The most important histological features are, wide xylem vessels, dissolution of the tyloses in the xylem vessels; the cortex and pith parenchyma cells were fully turgid and intact as well as the tissue had few intercellular spaces (Fig. 8). The neighboring vascular bundles parenchyma cells appeared at the beginning of plasmolysis and became small with degradation of the primary cell walls. In addition, little degradation of the secondary wall thickenings in the xylem vessels, and dissolution of latex in laticifers occurred (Fig. 9). These anatomical features were associated with the starting of senescence.

The increase in water uptake by dahlia inflorescence due to ethanol treatment might be attributed to its effect on dissolving the latex components (Balbaa *et al.*, 1976). In addition, dissolving tyloses in the xylem vessels by ethanol led to increasing the water uptake through the conducting vessels. In this context, it could be suggested that entry of water might be retarded or prevented by the deposition of hydrophobic material and tyloses in the xylem vessels.

2.2. Effect of searing on the internal structure of the flower stem:

Figures (10) and (11) show cross and longitudinal sections through the basal part of searing the stem ends which were subjected to searing treatment for 15 seconds followed by pulsing in STS for 10 minutes then 1.5 % sucrose. It is clear that the cortex tissues were damaged in addition to dissolution and degradation of cell components (Fig., 10). The most important anatomical features are the damage of the vascular elements and the degradation of the secondary wall thickening (Fig. 8) leading to reducing water uptake. In addition, the basal part of the stem became brown due to the searing treatment (Fig. 11). The effect of searing on the anatomical structure of the stem might be due to its effect on the changes in the cell membrane structure and function leading to the loss of integrity and permeability. Although searing treatment coagulated the latex, it also denatured membrane protein leading to less water movement through the xylem vessels than ethanol treatment.

2.3. Effect of boiling water on the internal structure of the flower stem:

The effect of placing the stem ends in boiling water for one minute followed by placing in STS and 1.5 % sucrose on anatomy of the base the stem is shown in Figures (12&13). There were hydrolysis and dissolution of

Fig. 8: Cross section through the basal part of the stem of the cut inflorescence 5 days after placing the stem ends in the 95 % ethanol for 5 minutes. Little anatomical changes were observed. Wide xylem vessels (XV) and dissolution of tyloses in the xylem vessels. [Obj. 10 x - Oc. 10 x]. L=Laticifers, CO=Cortex.

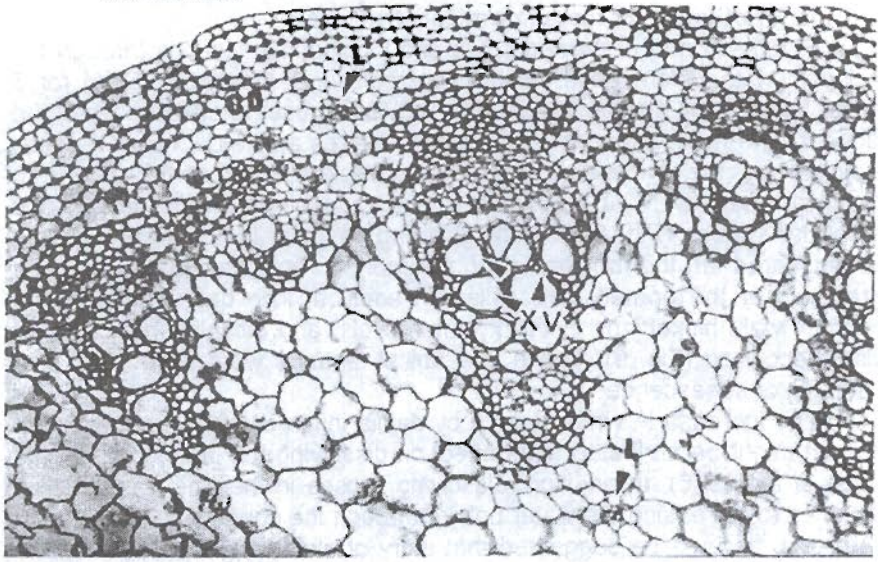


Fig. 9: Longitudinal section through the basal part of the stem of the cut inflorescence 5 days after placing the stem ends in the 95 % ethanol for 5 minutes showing little degradation of the secondary wall thickenings in the xylem vessels (XV) occurred, and laticifers (L) are clear of latex. [Obj. 10 x - Oc. 10 x].

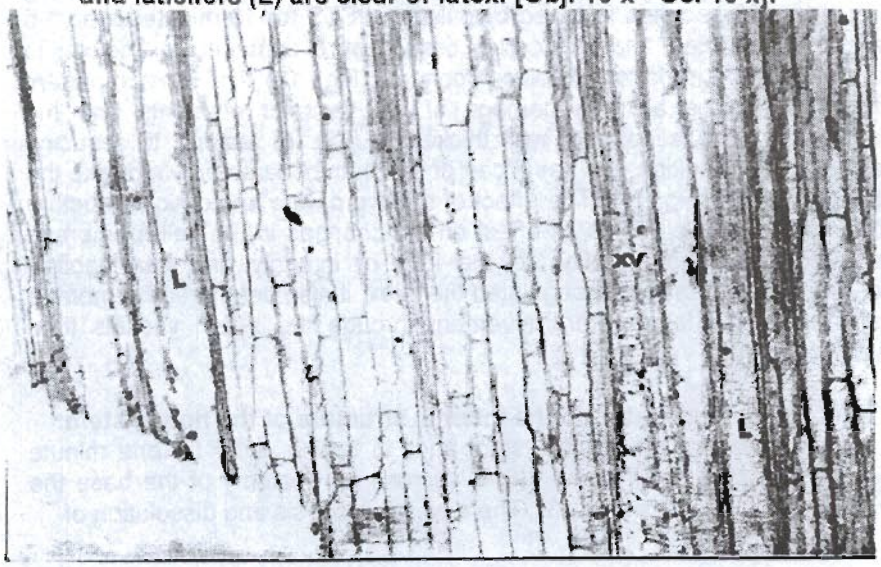


Fig. 10: Cross section through the basal part of the stem of the cut inflorescence 5 days after searing the stem ends for 15 seconds showing that cortex tissues (CO) were damaged. [Obj. 10 x - Oc. 10 x].

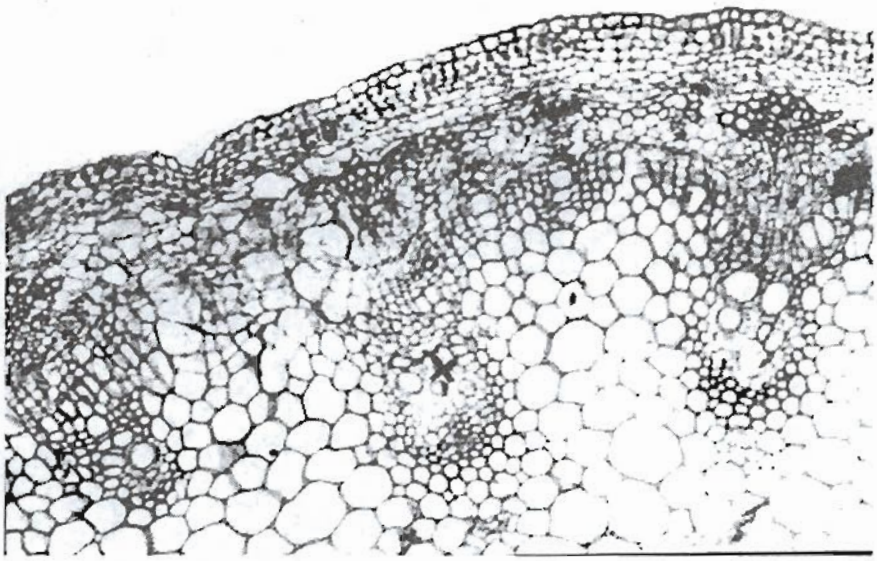


Fig. 11: Longitudinal section through the basal part of the stem of the cut Inflorescence 5 days after searing the stem ends for 15 seconds showing that the basal of the stem became brown; damage of the xylem vessels (XV) with degradation of the secondary wall thickening. [Obj. 10 x - Oc.10 x].

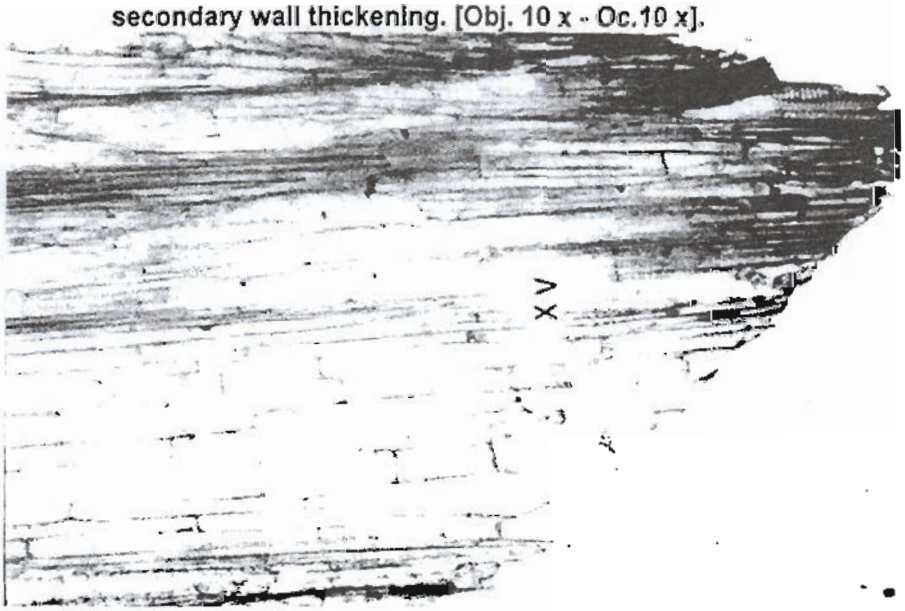


Fig. 12: Cross section through the basal part of the stem of the cut inflorescence 5 days after placing the stem end in a boiling water for one min., showing the hydrolysis and dissolution of cell components, the cortex tissue (CO) became gelatinous and showing degradation of some cells. [Obj. 10 x - Oc. 10 x].

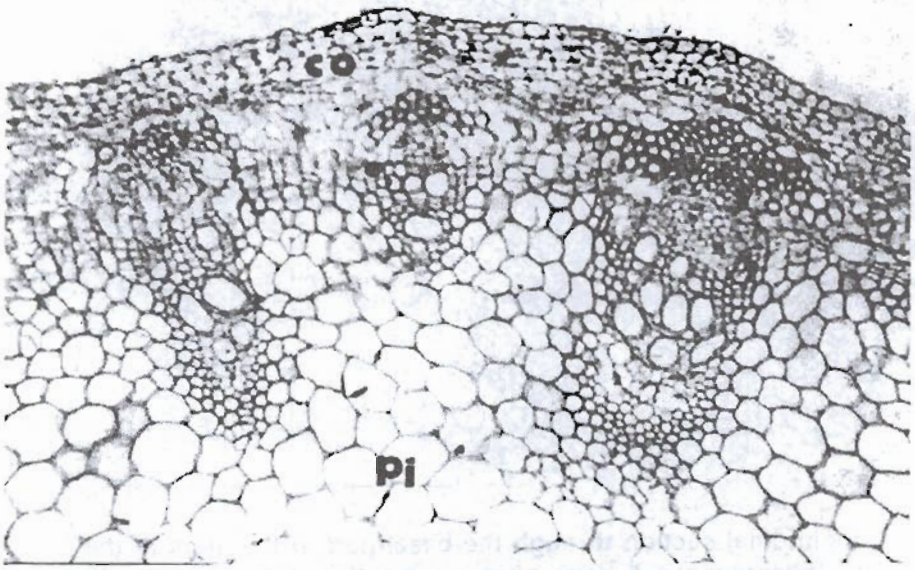
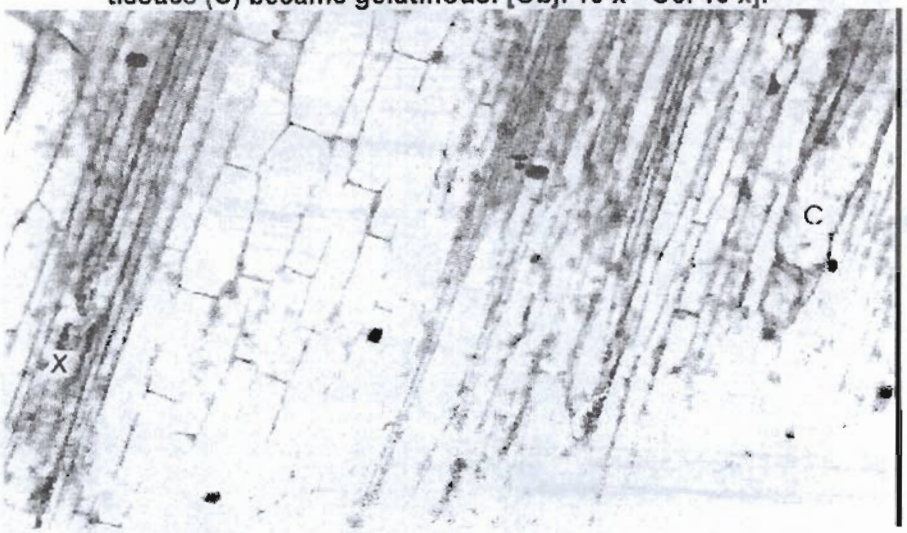


Fig. 13: Longitudinal section through the basal part of the stem of the cut inflorescence 5 days after placing the stem ends in a boiling water for one min. showing degradation in secondary wall thickening of some xylem vessels (X) and the cortex tissues (C) became gelatinous. [Obj. 10 x - Oc. 10 x].



cell components and the cortex tissue became gelatinous (Fig. 12). Also some degradation occurred in the secondary wall thickening of some xylem vessels and the cortex tissue became gelatinous (Fig. 13). These anatomical changes lead to less water uptake and accelerated senescence.

CONCLUSIONS

Thus, pulsing the stem ends in 95 % ethanol for 5 minutes followed by placing in STS, then in 1.5 % sucrose was the most effective combination led to least anatomical changes and delayed wilting and senescence than other postharvest treatments. These results might be attributed to the effect of ethanol on dissolving the tyloses in the xylem vessels and the latex at the cut surface of the stem leading to increasing water uptake and enhancement of the water movement through the xylem vessels. It is worthy to note that Rogers (1973) reported that treating poinsettia flowers with short stems in close proximity to heat (searing) might cause damage to the floral bracts. Accordingly, ethanol treatment, as a first stepwise procedure, could be recommended as the best method to prevent latex flow of cut dahlias. The role of STS on delaying the anatomical changes associated with wilting and senescence was mainly to inhibited bacterial growth which is the main reason for the reduced water uptake (Abdel-Kader, 1987). Moreover, STS increased the water uptake, and inhibited the action of ethylene (Pun et al, 2001). Sucrose in the holding solution plays an important role in delaying the anatomical changes associated with senescence. These results might be attributed to the role of sucrose as a metabolic sugar which contributes to growth and development, and improves the water balance due to its role in osmotic adjustment of the petals (Halevy, 1976). In addition, sucrose increases the cell wall thickening and lignification (Abdel-Kader, 1987; Steinitz, 1982), leading to delayed anatomical changes associated with senescence.

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دراسات ما بعد القطف على زهور الداليا (*Dahlia hybrida L.*)
الجزء الأول: تأثير معاملات وقف تدفق المادة اللبنية و الغمس (الإنباض) و محاليل الحفظ على العلاقات المائية للزهرة و التركيب التشريحى لساق الزهرة.

هشام هاشم عبد القادر و حسين على أحمد و خالد محمد حامد الهندى
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عند قطع زهور الداليا (*Dahlia hybrida* L.) التابعة للعائلة المركبة من النبات يخرج من قاعدة ساق الزهرة سائل لبنى يؤدى لإنسداد الأوعية الناقلة عند سطح القطع فى قاعدة الساق و يمنع إمتصاص الماء مما يؤدى إلى ذبول سريع للزهرة و قصر عمرها. و لقد تم عمل دراسة شاملة على معاملات ما بعد قطف لزهور الداليا خلال العامين المتتاليين 1996/1995 و 1997/1996 فى قسم الخضر و الزينة بكلية الزراعة جامعة المنصورة. وهدفت الدراسة إلى تقويم تأثير معاملات ثلاثة مراحل متتالية بعد القطف و التفاعلات فيما بينها على عمر و جودة زهور الداليا المقطوفة. و كانت المعاملات هى : معاملات للقضاء على مشكلة المادة اللبنية (كونترول بدون معاملة و الغمس فى الإيثانول و الحرق فوق اللهب أو الغمس فى الماء المغلى) و يليها معاملات غمس لمدة قصيرة (محلول ثيوكبريتات الفضة (STS) أو مركب مضاد حيوى أو 8-هيدروكسى كوينولين سلفات (8-HQS)) و فى الخطوة النهائية تم إستخدام مكونات مختلفة لمحاليل الحفظ (سكروز و حمض البوريك و حمض الستريك و السيكوسيل (CCC)).

وفى هذا الجزء (الأول) تم تقويم تأثير هذه المعاملات على العلاقات المائية و التغيرات الحادثة فى التركيب التشريحى الداخلى فى قاعدة ساق الزهرة المقطوفة. ولقد أظهرت النتائج أن غمس 5 سم من قاعدة ساق الزهرة فى كحول الإيثانول (95%) هى أفضل طريقة للتغلب على مشكلة (المادة اللبنية) و تؤدى إلى أكبر كمية إمتصاص للماء و الحفاظ على الوزن الطازج بقيم مرتفعة لفترة أطول عن معاملتى اللهب و الماء المغلى. ولقد أرجع تأثير الكحول إلى إذابته لمكونات المادة اللبنية. و أدى غمس الساق (الإنباض) فى محلول 4 ملليمولر من ثيوكبريتات الفضة STS لمدة 10 دقائق إلى تحديد نمو البكتريا و أكبر كمية إمتصاص للماء و الحفاظ على الوزن الطازج بقيم مرتفعة. و بالرغم من أن حمض الستريك كان أقل قيمة لدرجة الحموضة و أقل نمو للبكتريا و أعلى كمية إمتصاص للماء إلا أن السكروز 1.5% أدى إلى إحتفاظ الزهرة المقطوفة بوزنها الطازج بقيم مرتفعة لفترة أطول من كل محاليل الحفظ الأخرى. وقد نتج عن حمض البوريك و السيكوسيل كمية إمتصاص متوسطة للماء.

ولقد اظهرت الدراسات التشريحية أن التركيب التشريحى للساق ظهر به وجود العديد من الخلايا اللبنية متناثرة فى نسيج القشرة و خارج حدود الحزم الوعائية و أيضا فى أنسجة النخاع. بعد خمسة أيام من المعاملات فإن الزهور الغير معاملة (الكونترول) ظهر بها تكوين للتيلوزات فى الأنسجة الوعائية للخشب كما ظهرت أوعية الخشب ضيقة، وحدث لخلايا البشرة و النخاع بلزمة تلاها تحلل لمكونات الخلية و ظهر إنفصال و تباعد الأنسجة الوعائية بالساق. أما الزهور التى عوملت بالكحول فإنها حافظت على تركيبها التشريحى وهو أوعية خشب واسعة مع ذوبان التيلوزات و ظلت الخلايا البارنشيمية للقشرة و النخاع ممتلئة و متماسكة. و فى حالة الزهور المعاملة باللهب فإن الجزء السفلى للساق تلون باللون البنى وحدثت أضرار لخلايا القشرة و أوعية الخشب. و الزهور التى عوملت بالماء المغلى تحللت فيها مكونات الخلايا مع تحلل التغليف الثانوى لبعض أوعية الخشب و أصبحت خلايا القشرة جيلاتينية.