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EFFECT OF GROWTH REGULATORS AND PRESERVATIVE SOLUTIONS ON VASE LIFE AND WATER RELATIONS FOR FLOWERS OF *RANUNCULUS ASIATICUS* L. AFTER CUTTING

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Abstract

This experiment was conducted at the Al–Musaib Technical College in the province of Babylon at the autumn season of (2016-2017). For study the effect of five concentrations of growth regulator of (0, 25 GA3, 50 GA3, 100 Salicylic acid, 150 Salicylic acid) mg/L, and three types of preservative solutions and their effect on the vase life and water relations for flowers of Ranunculus asiaticus L. after Cutting . The results showed that treatment of GA3 (50 mg / L) was significantly excelled by giving them the highest values in the traits of relative fresh weight of 148.78%, Absorbed water of 41.38 g /flower stem/day, the lost water of 20.07 g /flower stem/day, water balance of 18.31 g /flower stem/day, vase life 15.40 days, dry weight of flowers 10.26 g, and carbohydrate content in petals 16.58%. As for the anthocyanin pigment in the Ranunculus flower petals, the salicylic acid treatment with concentration of 150 mg/L was significantly excelled than of the other treatments which gave 17.95 mg/100g dry weight. The second solution that consists of (5% sucrose + 200 mg / L 8. HQS + 200 mg/L citric acid) is significantly excelled in the traits of relative fresh weight of 153.46%, absorbed water 42.49 g/flower stem/day, the lost water 24.55 g /flower stem/day, water balance 21.03 g /flower stem/day, vase life 15.55 days, Dry weight of flowers 10.52 g, carbohydrate content in petals 17.93%, Anthocyanin pigment 21.24 mg/100g dry weight. Treatment of interaction between growth regulators and preservative solutions was characterized, The interaction treatment that consists of (50 mg/L + second solution) was significantly excelled on the other interaction treatments in traits of the relative fresh weight 160.69%, absorbed water 48.73 g/flower stem/day, the lost water 17.49 g/flower stem/day, water balance 31.24 g/flower stem/day, vase life 18.67 days, dry weight of flower 11.82 g, carbohydrate content in petals 20.78%. As for the anthocyanin pigment in the Ranunculus flower petals, the treatment that consist of (Salicylic acid with concentration of 150 mg/L + second solution) was significantly excelled on the rest of the treatments and gave 26.11 mg/100g dry weight.

Key words : *Ranunculus asiaticus*, vase life, preservative solutions, salicylic acid, gibberellin acid, water relations, senescence.

Introduction

Ranunculus asiaticus L. belongs to the Ranunculaceae family that includes more than (250-800) type. It has numerous names such as: constan tinopolitanus, Persian Buttercup and celery flower (Rickard, 2011). It is a winter annual flowering bulbs of dicotyledoneae, its preferably areas with moderate temperatures, the Mediterranean region is original home to it, also is spreading cultivation in Eastern of Europe, some regions of Africa, Asia, Syria and Iran also grows well in some parts of Iraq (Emadzade *et al*., 2011). Ranunculus is grown in the vessels to beautify the entrances and pathways as cultivates in the gardens on the side of the roads to give the place aesthetic value, and its commercial importance comes because its flowers suitable for commercial cutting, especially type of *Ranunculus asiaticus*. Flowers are used mainly in the flower bouquets either individually or in combination with other flowers (Bernstein *et al*., 2011). Ranunculus is a branching herbaceous plant and its height reaches between (20-50) cm. The leaves are palmately veined, which is a complete or a composite divided by a multi-

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tripartite division, its combined on the soil surface, which is arise near the from the area of the crown plant and some of them are located on the branches and in a mutual situation (Lehnebach, 2008). Flowers are single hermophrodite or combined together in a clusters manner where each 1-4 of flowers on the flowering stem. The flowers are with different colors, such as: red, pink, orange, yellow and white crimson, including the Single and double flowers, which containing five leaves sepals (Horandl, 2008). That the life of the flowers of Ranunculus after the cutting is affected by the evolutionary stage for flower either when flower cutting or when treatment it by some chemicals materials, including the growth regulators (Salicylic and GA_3), which delay the senescence of flowers and inhibition of ethylene action which causes rapid downfall of the petals, growth regulators also limit the activity of the analyst enzymes for flowers cells, which enables it to delay the appearance of signs of the expiration vase life such as wrap, shrinkage of the petals and reduce the transpiration rates of petals. As the components of preservative solutions also work, especially sucrose, which is the main source of energy needed to continue the life of flowers after cutting, and citric acid, which works to fixation the PH of the solution, which facilitates the absorption of substance solution easily as well as the role of substance 8-Hydroxyquinoline-sulfonic acid (8HQS), which positively affect in the life of the flowers after the cutting and act as a sterile material that prevents the growth of microorganisms and bacteria and prevent the closure of vessels stem and prevent the transport of water to flower, these materials work together on prolong vase life for Ranunculus (Banaee *et al*., 2013; Li *et al*., 2017).

In view of the above, the aim of the research is to determine the best concentration of Salicylic acid and Gibberellin, the best preservative solution to increase the vase life of Ranunculus flowers and study the interaction between the types of preservative solutions and the growth regulators and their effect on the water relations of the life of Ranunculus flowers after cutting.

Materials and Methods

Implementation of the experiment

This experiment was conducted at the Al–Musaib Technical College in the province of Babylon at the autumn season of (2016-2017), where it was cultivated the tuberous roots of Ranunculus cv. (red) on 25/10/2016, to study the effect of the addition of growth organizations (Salicylic, GA_3) and preservation solutions after cutting with water relations and the vase life for Ranunculus flowers, the tuberous roots were soaked in water for 8 hours and then cultivated in a 27 cm diameter plastic Flowerpot filled with an agricultural media consisting of [loamy sand + (1/2 Peat moss + 1/2 plant residues)] with the ratio of 1: 3, all service operations such as irrigation, fertilization and control were conducted as needed to obtain flowers of good quality and suitable for cutting. The flowers of Ranunculus were cut when the color of the flower bud appeared and at sunset. 1 cm of the bases of flower stems was cut into vessels which contained water. The lengths of the flowers stem were unified to 20 cm length, then transferred flowers to a room at a temperature (15 ± 2) with 12 hours lighting rate, Ranunculus flowers were placed in plastic flowerpot which contained on a 250 ml preservation solution. The preservation solutions did not change the length of the experiment.

Factors and levels of experiment

First factor : Growth regulators

Two types of growth regulators were used: Salicylic acid by dissolving the weights used in 5 ml of ethanol alcohol with concentration of 98% and then weights were placed separately in a volumetric flask and filled the size to 1 liter, Gibberellin acid in the form of powder was used, and Gibberellin acid ratio was 90%. The growth regulators attended as preservation solutions to prolong vase life of flowers and according to the following concentrations: (0, 25 GA_3, 50 GA_3, 100 salicylic acid, 150 salicylic acid) mg/L.

Second factor : Preservative solutions

Preservative solutions consisting of sucrose was adopted as a source of energy needed for the growth of flowers and 8-Hydroxyquinoline sulfate (8-HQS), it's an important sterile material that limits the growth of microorganisms, pure citric acid was added with a concentration of 98% to make the media is acidic, and the solutions were prepared according to the following concentrations :

1. **Distilled water**
2. **First solution** (2.5% sucrose + 100 mg / L 8.HQS + 100 mg / L citric acid)
3. **Second solution** (5% sucrose + 200 mg / l 8.HQS + 200 mg / L citric acid).

Experimental design

The experiment was carried out as a factorial experiment (3 × 5) according to Randomized Complete Blocks Design (R.C.B.D), with three replicates, each one of them containing 15 treatments with four flowers per experimental unit, and the averages were compared to according to the test of less significant difference

(L.S.D) under 5% probability level (Alsahoeke and Wahib, 1990). Data were analyzed using the ready statistical program (Genstat).

The studied traits

Relative fresh weight of cutting flowers) (%)

The weight of the flowers was measured after the cutting and before they were placed in the preservation solutions by a sensitive balance and then were measured weights every two days until the loss of flowers its coordination value, and was measured the relatively fresh weight according to Equation (1) (He *et al*., 2006) :

$$\text{RFW}(\%) = \frac{\text{Fresh weight at the day is } 0, 2, 4, ..., \text{etc.}}{\text{Weight at } 0 \text{ day}} \times 100 \quad (1)$$

Day (0) : is the first day to start the experiment.

Absorbed water (g /flower stem/day)

The absorbed water was calculated by measuring the weight of the preservation solution on the day 0, measuring its weight every two days until the loss of flowers its coordination value and according to equation (2) (He *et al*., 2006) :

Absorbed water = The weight of the solution at the start of the experiment – The weight of the solution in the day 0, 2,4, ... etc. (2)

The lost water (g /flower stem/day)

The lost water was calculated by weighing the cut flowers with their solutions on the first day and then measuring their weight together and then re-weight every two days until the loss of flowers its coordination value and according to Equation (3) (He *et al*., 2006) :

The lost water = The weight of flowers with their solutions at the start of the experiment – The weight of flowers with their solutions in the day 0, 2, 4, ... etc. (3)

Water balance (g /flower stem/day)

Water balance was calculated according to Equation (4) (He *et al*., 2006) :

Water balance = Absorbed water – The lost water (4)

Dry weight of cutting flowers (g)

The flowers were dried with their flowering stems by placing them in perforated bags and then placed in an electric oven at 70°C until the weight was stable and weighed with a sensitive balance.

The percentage of carbohydrates in petals (%)

Total carbohydrate content in petals was estimated according to the method mentioned by Joslyn, 1970).

Estimate anthocyanin's pigment in the petals (mg/100g dry weight)

Anthocyanin pigment was estimated in the petals by Ranganna method (Ranganna, 1977) by using Spectrophotometer device and with a wavelength of 535 nm

Vase life (day)

It was calculated by the number of days from cutting flowers and placing them in preservation solutions until the loss of flowers its coordination value (Taher, 2017).

Results

First : Effect of the growth regulators and the preservative solutions and the interaction between them in traits of the relative fresh weight, absorbed water, lost water and the water balance of Ranunculus cutting flowers.

Figs. 1, 2, 4 show that the relative fresh weight, absorbed water, and water balance were significantly increased during the first 8 days from life of Ranunculus cutting, but it decreased significantly from this time and gradually until the end of the experiment. While, fig. 3 shows that the lost water was significantly increased from placed the flowers in the preservative solutions until the end of the vase life. Table 1 shows growth regulators have a significantly role in influencing Ranunculus flower life after cutting. The results showed that treatment of GA3 (50 mg / L) was significantly excelled than other treatments in the traits of relative fresh weight, water absorbed, water lost, and water balance, as it reached 148.78%, (41.38, 20.07, 18.31) g/flower stem/day respectively, while the control treatment gave the lowest rate of the mentioned traits reached (134.64%, 26.89, 30.03, -3.14 g/flower stem/day), respectively. The type of preservative solution affected significantly in maintaining the quality of flowers as long as possible. The results of the same table showed that the treatment of the second solution was significantly excelled in the studied traits, and the relative fresh weight gave of 153.46%, Absorbed water of 42.49 g/flower stem/day, the lost water of 24.55 g /flower stem/day, water balance of 21.03 g/flower stem/day, followed by the treatment of the first solution, which gave the second highest values for traits of the relative fresh weight of 144.09%, the absorbed water 36.45 g/floral stalk/day, the lost water 24.61 g/flower stem/day, water balance 11.41 g/flower stem/day, while the control treatment gave the lowest values for the relative fresh weight of 134.86%, the absorbed water of 27.00 g/flower stem/day, the lost water of 28.00 g/flower stem/day, water balance of -3.66 g/

Table 1 : Effect of growth regulators and preservative solutions and the interaction between them in relative fresh weight, absorbed water, lost water and water balance of Ranunculus flowers.

Growth regulators (mg/L) (A)	Preservative solutions (B)	Relative fresh weight (%)	Absorbed water (g/flower stem/day)	The lost water (g/flower stem/day)	Water balance (g/flower stem/day)
Without adding	Distilled water	123.41	19.46	34.79	15.33-
	First solution	134.77	28.11	28.38	0.28-
	Second solution	145.74	33.13	26.92	6.20
100 Salicylic	Distilled water	135.18	26.61	30.77	4.16-
	First solution	141.07	35.39	28.90	9.75
	Second solution	149.40	40.37	30.12	17.63
150 Salicylic	Distilled water	138.63	28.94	28.73	0.04
	First solution	149.53	37.57	25.64	13.27
	Second solution	153.19	44.64	24.30	24.22
25 Gibberellin	Distilled water	137.18	27.37	22.75	2.75-
	First solution	149.33	38.43	20.42	14.53
	Second solution	158.27	45.57	23.90	25.85
50 Gibberellin	Distilled water	139.88	32.62	22.99	3.89
	First solution	145.78	42.78	19.72	19.79
	Second solution	160.69	48.73	17.49	31.24
L.S.D %5 (AB)		8.66	0.95	1.69	1.92
Rates of growth regulators (mg/L) (A)		Relative fresh weight (%)	Absorbed water (g/flower stem/day)	The lost water (g/flower stem/day)	Water balance (g/flower stem/day)
Without adding		134.64	26.89	30.03	3.14-
100 Salicylic		141.88	34.12	29.93	7.74
150 Salicylic		147.12	37.05	26.22	12.51
25 Gibberellin		148.26	37.13	22.36	12.54
50 Gibberellin		148.78	41.38	20.07	18.31
L.S.D %5 (A)		5.00	0.55	0.98	1.11
Rates of preservative solutions (B)		Relative fresh weight (%)	Absorbed water (g/flower stem/day)	The lost water (g/flower stem/day)	Water balance (g/flower stem/day)
Distilled water		134.86	27.00	28.00	3.66-
First solution		144.09	36.45	24.61	11.41
Second solution		153.46	42.49	24.55	21.03
L.S.D %5 (B)		3.87	0.43	0.76	0.86

flower stem/day. The interaction between the factors of the experiment (growth regulators and preservative solutions) has a significant effect on increasing the studied traits, the interaction treatment which consisting of (50 mg/L GA3 + second solution) was significantly excelled on other interaction treatments in traits of the relative fresh weight of 160.69%, Absorbed water of 48.73 g / flower stem/day, the lost water of 17.49 g /flower stem/ day, water balance of 31.24 g /flower stem/day, all interaction treatments significantly excelled on the control treatment (without addition) which gave the lowest values to the traits of relative fresh weight of 123.41%, absorbed water of 19.46 g /flower stem/day, the lost water of 34.79 g /flower stem/day, water balance of -15.33g /flower stem/day. Fig. 5 shows some photograph of the experiment.

Second : The effect of growth regulators and

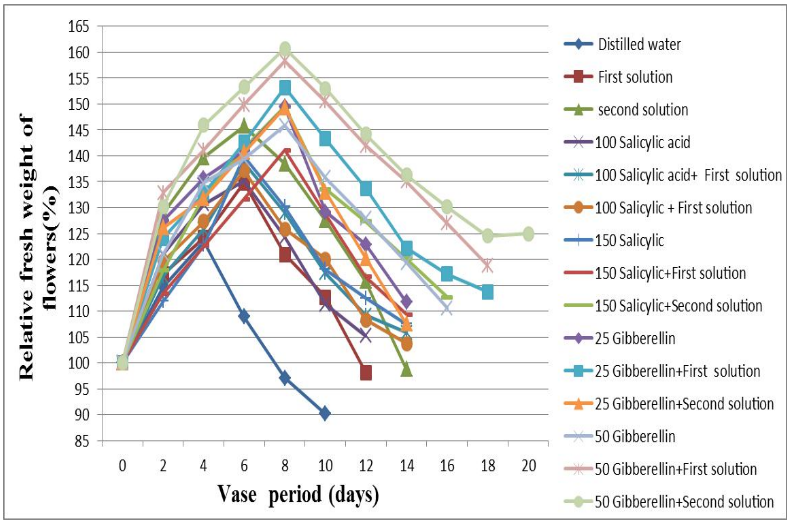

Fig. 1 : Effect of growth regulators and preservative solutions and the interaction between them in the relative fresh weight (%) of Ranunculus flowers.

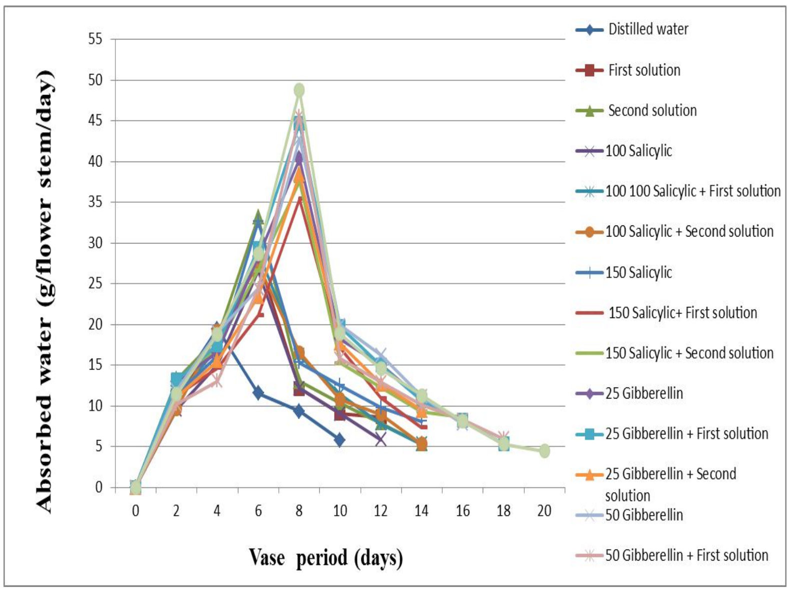

Fig. 2 : Effect of growth regulators and preservative solutions and the interaction between them in the absorbed water (g/flower stem/ day) of Ranunculus flowers.

preservative solutions and the interaction between them in the traits of vase life, dry weight, carbohydrate content and anthocyanin's pigment in petals for Ranunculus cutting flowers.

It is noted from the results of table 2 that the treatment of flowers with growth regulators has significantly contributed to the effect on the quality of Ranunculus flowers. The results showed that treatment of GA_3 (50 mg/L) was significantly excelled on the rest of the other treatments by giving it the highest vase life 15.40 days, dry weight of the flowers 10.26 g and the carbohydrate content in the petals 16.58%. As for the pigment of anthocyanin in the flower petals of Ranunculus, the salicylic acid treatment was significantly excelled with concentration of 150 mg/L by giving it 17.95 mg/100g dry weight. While the control treatment gave the lowest values compared to the rest of the other treatments, as a vase life reached of 10.28 days, dry weight of flowers 8.52 g, carbohydrate content in petals 12.33% and anthocyanin's pigment of 13.90 mg/100g dry weight. The results of the same table showed that the components of the preservative solutions (sucrose, citric acid and 8 HQS) combined have an important and significant role in increasing the vase life and preventing its senescence, and early flowers are damaged. The treatment of the second solution was significantly excelled in increasing the vase life, dry weight, total content of carbohydrates in petal and the anthocyanin's pigment for Ranunculus flowers, and gave of (15.55 days, 10.52 g, 17.93%, 21.24 mg/100g dry weight) respectively, followed by treatment of the first solution which gave of (13.21 days, 9.55 g, 14.19%, 17.72 mg/100g dry weight), respectively. While the control treatment gave the lowest values compared to the rest of the other treatments, as a vase life reached of 10.84 days, dry weight of flowers 8.25 g, carbohydrate content in petals 11.05% and anthocyanin's pigment of 13.48 mg/100g dry weight. The results of table 2 showed that the interaction between growth regulators and preservative solutions has an important and significantly role in maintaining quality and freshness of flowers as long as possible. The interaction treatment which consisting of (50 mg/L GA_3 + second solution) was significantly excelled on other interaction treatments in traits of the vase life of 18.67 days, the dry weight of the flower of 11.82 g and the carbohydrate content in the petals of 20.78%. As for the anthocyanin pigment in the flower petals of Ranunculus, the treatment of (Salicylic acid with concentration of 150 mg/L + the second solution) significantly excelled the rest of the treatments and gave 26.11 mg/100g dry weight. While the control treatment gave the lowest values for traits of the vase life 8.00 days, dry weight of flowers 7.58g, carbohydrate content in petals 10.14% and anthocyanin's pigment 10.59 mg/100g dry weight.

Discussion

The result showed that the 50 mg/L GA_3 treatment was significantly excelled on the rest of the other treatments for most studied traits. This is due to the

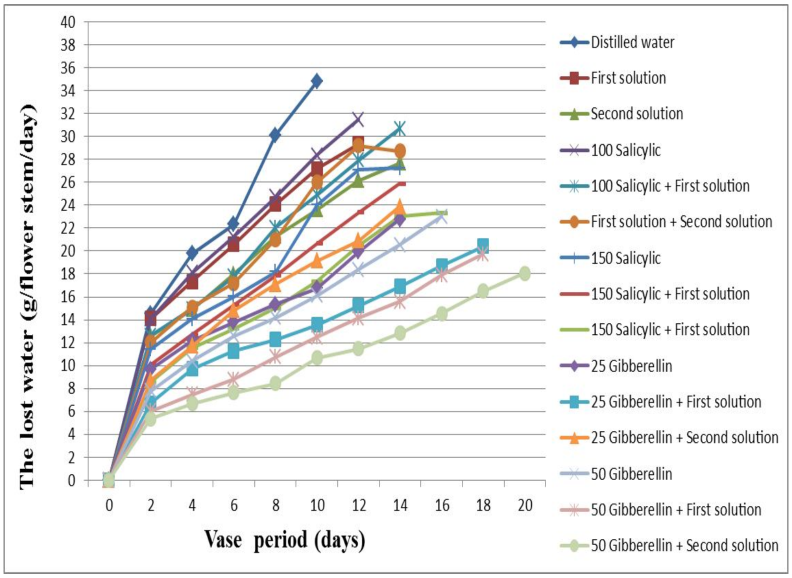

Fig. 3 : Effect of growth regulators and preservative solutions and the interaction between them in the lost water (g/flower stem/day) of Ranunculus flowers.

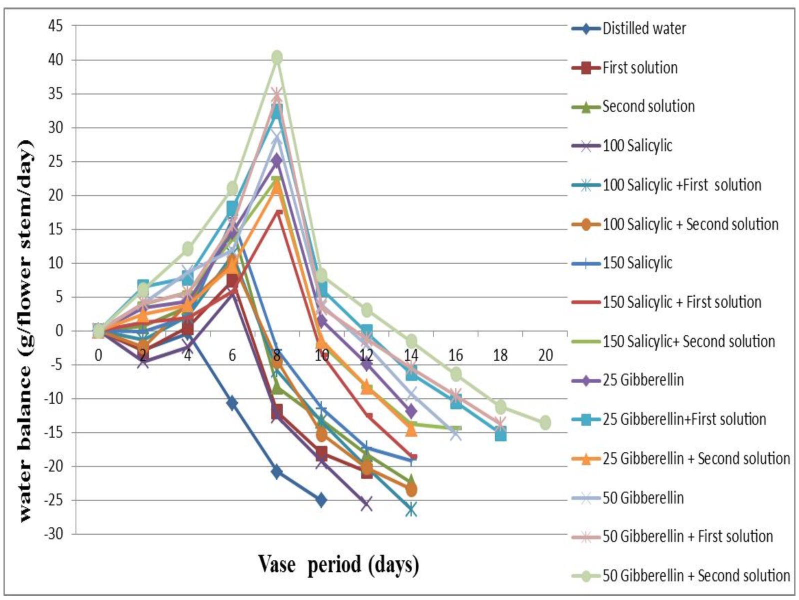

Fig. 4 : Effect of growth regulators and preservative solutions and the interaction between them in the water balance (g/flower stem/day) of Ranunculus flowers.

physiological effect of the Gibberellin acid in maintaining the quality of flowers after cutting by delaying many of the physiological processes, such as senescence. As It reduces the destroy of proteins, Starch and sugars that the reductive in the petals by delaying the activity of the protase enzyme, which destroys proteins and inhibits the process of peroxide fat, which may be one of the mechanisms responsible for the delay of senescence and has an important role in curbing the production of ethylene in the inflorescence, which encourages the start of the stage of senescence for flowers (Danaee *et al*., 2011; Rabiza-Swider *et al*., 2015) and inhibition of the action of ethylene which causes the rapid fall of the petals, or due to the role of Gibberellin in the cells division and increase the size and expansion of flower cells as well as increase their absorption of water by increasing flexibility and elasticity for the walls and increase its expansion (DeCosta *et al*., 2016). Increasing the surface area of the cells leads to an increase in the amount of water withdrawn from the flowers for that water will enter rapidly causing the cells swelling (Krzyminska *et al*., 2014). The Gibberellin works to reduce the loss of water from the flowers and reduce the transpiration that is associated with reduction in the permeability of the cellular membranes for the flowers (Emongor, 2004). Gibberellin has an important role in creating the water balance of cells and non-wilt and not to occur full flowering for flowers by maintaining the relationship between components of the water balance, which interfere strongly, which is the withdrawal of water, transfer and loss of water, and the ability of tissues to retain water (Sosa, 2007). Fig. 2 indicates that there is a continuous decline in water withdrawal by flowers with the length of its duration in the solutions and this leads to the lack of swelling of the cells. Gibberellin have an important role in swelling of cells and not losing dissolved materials from the cell, which adversely affect the osmosis pressure and thus lead to increase the traits of studied in table 1. Also the increase in the anthocyanin's pigment in the petals of Ranunculus may be due to the role of the motivational salicylic acid in the increase in the activity of some enzymes, including Phenylalanine ammonia-lyase, which converts the amino acid (Phenylanlaine) to Cinnamic acid and thus changes the course of the process of protein composition to the composition of phenol compounds. Since the dye of anthocyanins is one of the phenolic compounds, the salicylic will increase the formation of this dye in the Gerailoo and Ghasemnezhad, 2011; Hatamzadeh *et al*., 2012).

The results of the tables 1, 2 showed that the second preservative solution significantly excelled in most studied traits, Due to the components of preservative solution, which works together to maintain the vitality of flowers after the cut, Sucrose is one of the most important

Table 2 : Effect of growth regulators and preservative solutions and the interaction between them in the vase life, dry weight, percentage of carbohydrates in petals and anthocyanin's pigment for Ranunculus flowers.

Growth regulators (mg/L) (A)	**Preservative solutions (B)**	**Vase life (day)**	**Dry weight of petals (g)**	**Percentage of carbohydrates in petals (%)**	**Anthocyanin's pigment (mg/100g dry weight)**
Without adding	Distilled water	8.00	7.58	10.14	10.59
	First solution	10.67	8.81	11.50	14.36
	Second solution	12.17	9.18	15.36	16.76
100 Salicylic	Distilled water	10.33	8.16	10.57	13.40
	First solution	12.70	9.35	13.26	18.46
	Second solution	13.55	10.16	17.57	23.15
150 Salicylic	Distilled water	11.53	8.45	10.84	16.20
	First solution	14.50	9.81	15.95	20.74
	Second solution	17.33	10.82	18.10	26.11
25 Gibberellin	Distilled water	12.00	8.33	11.15	12.65
	First solution	13.00	9.57	13.83	16.21
	Second solution	16.03	10.61	17.84	19.76
50 Gibberellin	Distilled water	12.33	8.75	12.55	14.57
	First solution	15.20	10.22	16.41	18.85
	Second solution	18.67	11.82	20.78	20.44
L.S.D %5 (AB)	1.26	0.93	2.45	2.24	
Rates of growth regulators (mg/L) (A)		Vase life (day)	Dry weight of petals (g)	Percentage of carbohydrates in petals (%)	Anthocyanin's pigment (mg/100g dry weight)
Without adding		10.28	8.52	12.33	13.90
100 Salicylic		12.20	9.22	13.80	18.34
150 Salicylic		14.46	9.69	14.96	21.02
25 Gibberellin		13.68	9.50	14.27	16.21
50 Gibberellin		15.40	10.26	16.58	17.95
L.S.D %5 (A)		0.73	0.54	1.41	1.29
Rates of preservative solutions (B)		Vase life (day)	Dry weight of petals (g)	Percentage of carbohydrates in petals (%)	Anthocyanin's pigment (mg/100g dry weight)
Distilled water		10.84	8.25	11.05	13.48
First solution		13.21	9.55	14.19	17.72
Second solution		15.55	10.52	17.93	21.24
L.S.D %5 (B)		0.56	0.42	1.09	1.00

components of the preservative solution, as sucrose is transferred from the solution to the flowers to assemble in which. This leads to an increase in the concentration of the osmosis which accelerates the absorption of the solution and causes increased the bloating pressure and cause flowering and natural expansion of the petals and absorption of larger amounts of solution (Elhindi, 2012). It also leads to water tension, which is considered a determinant the vase life that expressed by the early wilt for leaves or flowers and that wilt occurs due to loss of cell swelling due to the imbalance between the quantity of water drawn from the base of the leg and water lost by transpiration, sucrose works to close the gaps to reduce transpiration and thus increase the traits studied in table 1 (Oraghi *et al*., 2013). Sucrose also increases cell metabolism and produces the necessary nutrients for cell growth, thus increasing the accumulation of starch and sugars reducing in flowers and thus increasing the

Fig. 5 : Some photographs of the experiment.

total carbohydrate for flowers (Elgimabia *et al.*, 2016). Increasing sucrose also improves the color of flowers by stimulating cells to produce enzymes necessary for the construction of plant pigments for Ranunculus flowers (Ahmadi and Hassani, 2015; Kumar *et al.*, 2009). The increase in the absorption of the solution is due to the role of 8-HQS in preventing the growth and accumulation of microorganisms in vase water or inside the carrier vessels in flower stem, which will lead to blockage of these vessels and block the transmission of water and sugars to the top and that sucrose preserves the safety of cellular membranes (Chanjirakul *et al*., 2014). The presence of microorganisms in conservation solution leads to the secretion of substances and enzymes that affect the pH of the solution and the development of harmful levels of ethylene. Therefore, the addition of 8-HQS leads to curbing the spread of microorganisms and prolonging the vase life of the Ranunculus flowers as shown in table 2 (Al-Mahdawy, 2009).

The results of interaction between the growth regulators and the preservative solutions indicated that the interaction treatment of (50 mg/L GA_3 + second solution) was significantly excelled in increasing the studied traits. This is due to the role of Gibberellin in maintaining the quality of flowers after cutting by controlling the enzymatic activity and the formation of nucleic acids and the motivate of auxins, which have an important role in the division and expansion of cells and improve the water relations of the cells and increase absorption of the preservative solution, the Gibberellins reduce from the breakdown of proteins and ammonia accumulation and delay activity of the protase enzyme which works to promote the flowering of buds flowers, the preservative solutions work to supply flowers with the necessary growth requirements for the continuation of vital processes such as sucrose, citric acid and 8 HQS, As these materials together with Gibberellin to maintain the continuity of full bloating of the cells petals, non-wilting and maintaining high cell pressure. These materials supply the cells with the energy necessary for breathing operations and prevent the rapid destruction of nutrients in the petals and maintain the freshness of flowers and not lose the color of petals and maintain it for as long as possible because of the continuity of processing sucrose that sustains its metabolic processes, Salicylic also plays an important role in increasing the anthocyanin pigment in the flower petals of Ranunculus due to the role of preservative solution and Salicylic acid, which stimulates the production of antioxidants and increase the composition of phenols, which are the basic structure in the formation of pigments plant especially anthocyanin's, increase their levels, and prevent their decomposition and destruction by raising the proportion Antioxidants especially Proxidase and Catalase super oxidase dismutase, which maintain the pigments from destruction. The sugars absorbed from the preservative solution act to maintain respiration rates and thereby increase the CO_2 production, which improves the anthocyanin's (Jalili *et al*., 2011; Kazemi *et al*., 2011; Gerailoo and Ghasemnezhad, 2011). The antimicrobial plays an important role in reducing the bacterial spread that closes the vessels and prevents the absorption of the solution. Citric acid has an important role in preserving the pH of the preservative solution, which accelerates the absorption of all the components of the preservative solution. In view of the above, the algebraic and preservative solutions work together in an interconnected way to prolong the vase life and increase the dry weight of the petals and the amount of carbohydrates and total carotenoids in the Ranunculus flower petals (Hassani and Alimirzaii, 2017; Rabiza-Swider *et al*., 2015; Krzyminska *et al*., 2014).

Conclusion

The growth regulators (Gibberellin and Salicylic) acid achieved a significantly excelled in maintaining the quality of flowers after cutting by reducing the effect of many physiological processes such as senescence, petals falling and lengthening the vase life for Ranunculus flowers, giving it the best results for all studied traits. The preservative solutions have a positive and significant effect on the increase of most of the studied traits due to the work of the components of preservative solutions (sucrose, 8-HQS, citric acid) combined in maintaining the quality of flowers after cutting as a result to preventing the growth of microorganisms in the vessels stem and the continuity of flower supply with the necessary energy requirements for Biological processes.

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Conflict of interest

The authors declare that they have no conflict of interest in the publication.

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