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EFFECT OF SPRAYING WITH A -TOCOPHEROL AND EXTRACT OF BLACK CUMIN SOAKED ON THE VEGETATIVE AND FLOWERING GROWTH OF *FREESIA HYBRID* L.

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Abstract

The experiment was conducted during the agricultural season 2021-2022 in lathhouse covered with a saran cover belonging to the Department of Horticulture and Landscaping Engineering at the College of Agriculture / University of Basrah, To study the effect of spraying with α -tocopherol and extract of soaked black cumin on the vegetative and flowering growth of Freesia hybrid L. for spraying with α -tocopherol at a concentration of (0,60,120) mg.l and extract of soaked black bean (80,40,g.g.liter ¹-of traits Vegetative growth and flowering, by three sprays between one spray and another 15 days. The results showed that spraying plants with A -tocopherol at a concentration of 120 mg.L^{-1} improved all indicators of vegetative and flowering growth, which included (plant height, number of leaves, leaf area, vase life, flowering period, number of florets and length of inflorescence. As for spraying plants with black cumin extract infused at a concentration of 80 g.L ,¹-a significant effect on (plant height, leaf area, number of leaves, vase life, flowering period, number of florets and stalk flower length, As for the bi-interactions between alpha-tocopherol at a concentration of 120 mg.L^{-1} and black cumin extract infused at a concentration of 80 g.L^{-1}, it gave the highest rates compared to the control plants.

Keywords: α –tocopherol, black cumin soaked, *Freesia hybrid* L.

Introduction

Freesia hybrid, belonging to the Iridaceae family was discovered by the scientist Friedrich Heinrich It odor in 1876 in southern Africa. The name of the genus belongs to the Swedish doctor and scientist Frees. (Albattal, 2010; Wulfighoff, 2001) It is a vine, annual, winter plant that contains bright green flat sap leaves, while the stem-shaped flowers are borne in comb inflorescences with flowers of different colors, including yellow, orange, white and red, and it has an aromatic smell. The plants flower in the spring and are suitable for commercial cutting. The freesia plant occupies the seventh place in the world among the cut flowers in terms of importance after the flowers of rose, Chrysanthemum , tulip, lily, carnation and gerbera (Laushman and Armitage 2003, Al-Batal, 2005, Al-Jalabi and Al-Khayyat 2013). The importance of the freesia plant as a picking flower is concentrated due to the beauty of its multi-colored flowers and sizes and the long period of flowering after cutting.It is of great importance because of the multiplicity of purposes of its cultivation, as it is grown in houses whose conditions are controlled in order to obtain flowers suitable for cutting throughout the year (Al-Dabaa and others, 2004.(Freesia multiplies by seeds or vines in autumn and spring, and it is a plant belonging to the Iris family (Al-Sultan et al., 1992 .(Foliar nutrition means spraying solutions of nutrients on the vegetative total of plants, and it is of great importance in providing plants with the nutrients necessary for their

continued growth and achieving an improvement in their quantitative and qualitative qualities. For plants (Fageria etal., 2009 and 2014, Kostadinov and Kostadinova .(The amount of fertilizer used in foliar nutrition is small, which leads to reducing the risks of environmental pollution of soil and water, as well as the ability to address the shortage of the plant and quickly, and the spread of the fertilizer material over all the vegetative growth, and the entry of the nutrient element into the plant easily, where it reduces the amount of energy required for the transfer of nutrients within the plant (Mohammed, 2011.)Studies have indicated that vitamins are vital compounds that enter as a growth regulator in low concentrations in the regulation of many growth processes, which represent the biological energy pathways inside the plant, specifically in the process of reduction and synthesis of enzymatic facilities for the a-Keto decarboxylation process, which is involved in the energy transfer process Trans-Ketolation in the phosphorylation cycle Optical Pentose phosphate synthesizes carbohydrates (Cohen, 1998). A -tocopherol is one of the most important lipid antioxidants that plays a protective role for the membrane system of the cell, making it an important part of the plant defence mechanisms that maintain the integrity of the natural function of the photosynthesis system. Tocopherols are found in all higher plants, in both photosynthetic and non-photosynthetic tissues. In addition, it is a component of chloroplast membranes that are very rich in polyunsaturated fatty acids. It protects the plastid membranes from oxidative stress through the formation of intrinsic lipid antioxidants (Manne-Boschand Alegre, 2008, Shao etal., 2008). El-Quesni et al(2009) found that spraying Hibsisus rosa Sinensis L. with tocopherol at concentrations of 50 and 100 mg l. It led to a significant increase in growth indicators, which included plant height and fresh weight of the stem and roots, and the treatment at a concentration of 100 mg.l^{1-} gave the highest values. The developers (2013) concluded that spraying okra plants Abelmoschus esculentus L. with tocopherol at concentrations (0, 50, 100 and 150) mg L. led to a significant increase in vegetative growth, which included plant height and number of leaves , Leaf area, number of lateral branches of plant, percentage of total soluble carbohydrates in leaves, amount of chlorophyll and flowering growth at concentration 150 mg.l^{1-} compared to control plants. Studies have shown that there are many plant extracts that have an effect on encouraging the vegetative and flowering growth traits of many plants. The reason for this is that these plants contain a number of natural chemical compounds, which differ qualitatively and quantitatively according to the different species and plant parts, as well as according to the different environmental conditions and stages of plant growth to which it is exposed (Omran, 2004). Muhammad (1985) found that some plant extracts encourage lateral root branching (root dispersal) by containing cytokinin, which stimulates the growth of lateral roots and the role played by these roots in the transfer of materials and nutrients inside the plant more, which increases the rate of vegetative growth of plants treated with extracts and its contents (black cumin) Al-Nuaimi (1984) noted that black cumin extract provides the seedlings with carbohydrates by 20-35%, and that this increase in the level of carbohydrates allows the vegetative meristem cells to accelerate their division and elongation.Abu Dahi (1998) explained that black cumin extract helps in storing phosphorous by forming the amino acid phytin, as well as reducing nitrates, increasing biological nitrogen fixation by forming amides, which increases the abundance of vegetative growth

represented by increasing plant height and increasing stem diameter and other traits and the importance of the freesia plant in landscaping and planting it in large pots inside buildings to decorate the places and because there was no study under the conditions in Basra Governorate, this current study was conducted.

Materials and methods:

The experiment was conducted in lathhouse covered with a saran cover belonging to the Department of Horticulture and Garden Engineering at the College of Agriculture - University of Basra, Karmat Ali site, for the period from 1/5/2021 to 1/5/2022. and at a ratio of 1:1, respectively (Table 1). Plants were sprayed with A -ocopherol (Vitamin E) in three concentrations (120,60,0) $mg.L^{1-}$ It was prepared by dissolving the required weights with a little distilled water and then completing the volume to the liter. And extract soaked black cumin in three concentrations (80,40,0 $g.L^{1-}$ Prepare by dissolving the required weights of dry powder in a liter of warm distilled water at a temperature of 50°C and leaving for 24 hours. A few drops of Tween-20 diffuser were added to all solutions before spraying (Lazem et al., 2013). The plants were sprayed three times between one spray and another 15 days during the growing season. The experiment was conducted according to a randomized complete block design (R.B.C.D) and a factorial experiment and with three repetitions.The means were compared using the least significant difference test to compare the means at the 0.05 probability level (Al-Rawi and Khalaf Allah, 1980).

Table (1) shows some chemical and physical properties of the soil used in the experiment

units	**values**	traits
Dsm^{-1}	**5.54**	Electrical conductivity (EC)
——	**8.13**	pH
mg.kg-1	**23.4**	Total nitrogen (N)
mg.kg-1	**56.18**	available phosphorous (P)
mg.kg-1	**485 – 7125**	available Potassium (K)
——	**——**	Soil Separators
%	**78**	sand
%	**10**	Silt
%	**12**	Clay
	Loamy sand	soil texture

Table (2): Chemical and physical properties of peat moss (Klass-man).

values	traits
4.5 – 3.5	pH
97 – 95	Organic matter (%)
1	Total Nitrate (%)
50	Moisture retention (%)
90 – 70	Density (g. cm)

vegetative traits.

1- plant height (cm)

The height of each of the experimental plants was measured from each experimental unit from the surface of the soil to the highest part of the plant using the measuring tape and its average was recorded.

2- Total number of leaves (leaf. plant $^{-1}$)

According to the total number of leaves for each plant of the experimental unit, its average was recorded.

3- Leaf area (cm^2)

The leaf area before flowering was calculated according to the following equation given in Aydinsakir and Buyuktas (2009) and its average was recorded.

Leaf area (AL) = WL x 0.91 x number of total leaves

where W is the width of leaves (cm)

L represents the length of the leaf (cm)

Indicators of flower growth

1- vase life (day after planting)

The number of days from growing the corms until the first inflorescence of the inflorescence was opened for each plant of the experimental unit was calculated and averaged.

2- Duration of flowering (day)

The number of days from the opening of the first inflorescence until the end of the coordination value of the last inflorescence of the inflorescence for each plant of the experimental unit was calculated and its average was recorded.

3- The number of florets (floret.inflorescence $^{1-}$)

The number of florets per inflorescence of each plant in the experimental unit was calculated and its average was recorded.

4- The length of flower stalk (cm)

The length of the inflorescence stand was measured from the point of its contact with the soil to the top of the inflorescence by means of a tape measure for each plant of the experimental unit and its average was recorded.

Results and discussion

traits of vegetative growth:

1- plant height (cm)

It is noted from the results in Table (3) that spraying plants with vitamin A -tocopherol has a significant effect on plant height, where plants sprayed with vitamin E at a concentration of 120 mg.L^{-1} were significantly excelled and gave a height of 48.18 cm on both plants and treated with the same vitamin, but at a concentration of 60 mg.L^{-1} and the control treatment, and their average height was 42.96 cm and 37.25 cm, respectively, and at the same time, the plants treated with a concentration of 60 mg.L^{-1} excelled the control plants.The increase in plant height is due to its role in increasing the division and effectiveness of a number of amylase-β enzymes and Glocosidase and others, or its help in building other enzymes such as protase and lipase (Simirnoff and Wheeler, 2000).Perhaps as a result of the increased absorption of macro elements that accumulate inside the plant and thus lead to an increase in the processes of plant cell division and differentiation and the preservation of chloroplast and its effect on the process of photosynthesis and its products (Dowdle et al, 2007). Which led to an increase in plant height, and this result is consistent with what was found by (2010) Eid et al on jasmine plant and Soltani et al (2012) on chrysanthemum plant and Ali (2020) on senna plant. It is clear from table (3) that spraying with black cumin extract has a significant effect on plant height, The plants treated with the extract of black cumin soaked at a concentration of 80 and 40 g.l^{-1} significantly excelled and gave a height of 47.96 and 43.97 cm, respectively, compared to the control plants, whose average height was 36.44 cm .The effect increased by increasing the concentration used, and this may be due to the nutrients that the drenched black cumin extract contains sufficient for what the plant needs in the processes of cell division and elongation, and the subsequent effect of absorbing water and nutrients that work to increase vegetative growth, which led to an increase in Plant height (Devlin and Wedham 1993; Nasser and Saad Eddin 2013) or it may be due to the fact that the black cumin extract contains auxiliary substances in the storage of phosphorus with the formation of histidine and phytin, as well as the reduction of nitrates and the increase of biological nitrogen fixation by the formation of amides, which increases the abundance of vegetative growth represented by increasing the height of the plant (Abu Dhahi, 1998). This finding agrees with Al-Shammari (2015) on the pepper plant.As for the bi-interaction between vitamin E and spraying with black cumin extract soaked, it had a significant effect on plant height.The plants that were sprayed with vitamin E at a concentration of 120 mg.L^{-1} and black cumin extract at a concentration of 80 g.L^{-1} gave the highest height of 50.70 cm compared to the lowest height of 21.67 cm was the control plants.

Table (3) Effect of spraying with α-tocopherol and extract of black cumin soaked and their interaction on plant height (cm) of Freesia hybrid L..

soaked black cumin extract average	α -tocopherol concentration mg.L^{-1}			Concentration of soaked black cumin extract g. $liter^{-1}$
	120	60	0	

36.44	**47.67**	**40.00**	**21.67**	**0**
43.97	**46.17**	**43.76**	**42.00**	**40**
47.96	**50.70**	**45.11**	**48.08**	**80**
	48.18	**42.96**	**37.25**	**α –tocopherol average**

L.S.D value at 0.05 . level

Interaction between black cumin extract and alpha-tocopherol	**α -tocopherol concentration mg.L^{1-}**	**Concentration of soaked black cumin extract g. liter^{-1}**
1.06	**0.61**	**0.61**

2- The number of leaves (leaf. plant^{1-})

It was found from the results in Table (4) that spraying plants with α-tocopherol had a significant effect on the number of leaves, where the plants treated with α-tocopherol at a concentration of 120 mg.L excelled in the number of leaves, which amounted to 10.35 leaves. At a concentration of 60 mg.L^{1-} and the control plants, which amounted to 9.50 and 7.79 leaves^{1-}, respectively. The plants sprayed with α-tocopherol at a concentration of 60 mg.l^{1-} significantly increased the number of leaves that reached 9.50 leaves. plant^{1-} compared to the control plants, which had 7.79 leaves. plant^{1-}. It may be due to a reason when treating plants with this vitamin, which led to an increase in the nitrogen content in the plant, which is important in the manufacture of carbohydrates and their accumulation in large quantities and the formation of a strong tabular root system that has the ability to absorb the elements necessary for plant growth and increase the efficiency of the photosynthesis process and this is reflected in the formation of a strong structure of the plant represented In increasing the number of total leaves or perhaps the reason is that spraying plants with vitamin E increases the levels of macro elements in the plant, which is a positive indicator in increasing the efficiency of the photosynthesis process, which is positively reflected on an increase in vegetative growth, including an increase in the number of leaves. This result agrees with Ali (2020) in her study of a plant Senna. As for the reason for the increase in the number of total leaves when spraying with vitamin E, it is due to its role in increasing the enzymatic activity of the enzymes responsible for the photosynthesis process, which was positively reflected in the increase in the number of leaves (Mohammed and Al-Younis, 1991). This result agrees with Ali (2020) in

her study of senna .Table (4) showed that spraying with black cumin soaked extract at a concentration of 80 gm.l had a significant effect on increasing the total number of leaves of the plant, which amounted to 10.01 leaves.plant^{-1}, compared with plants sprayed with the same extract at a concentration of 40 g.L^{-1}. and the control plants in the total number of leaves of the plant. The number of leaves reached 9.53 and 8.09 leaves .plant^{-1}, respectively. The reason for the increase in the number of leaves may be due to an increase in the concentration of the spray because the extract contains nutrients, including the nitrogen element, which leads to an increase in the plant height , which was positively reflected on the increase in the number of leaves (Al-Sahhaf, 1989) or the reason may be due to the fact that the extract of soaked black cumin contains growth-stimulating substances such as vitamin B1, B2 and B3, which have an important role in the metabolism of carbohydrates and building amino acids that represent the basic units for building proteins, which was positively reflected in the increase in growth and the number of leaves (Abdul Nasser and Saad Eddin, 2013). As for the bilateral interaction between spraying with alpha-tocopherol and black cumin extract, it had a significant effect on the number of leaves. The plants sprayed with α -ocopherol at a concentration of 120 mg.l^{-1} and black cumin extract at a concentration of 80gm.l^{-1} produced the highest number of leaves, which amounted to 11.19 leaves, compared to the lowest number of leaves formed by the control plants, which reached 6.00 leaves.

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Table (4) Effect of spraying with α -ocopherol and extract of black cumin soaked and the interaction between them on the total number of leaves (leaf. plant $^{-1}$) of Freesia hybrid L. .

soked black cumin extract average	α -tocopherol concentration mg.L^{-1}			Concentration of soaked black cumin extract g. liter^{-1}
	120	60	0	
8.09	9.34	8.93	6.00	0
9.53	10.50	9.75	8.35	40
10.01	11.19	9.82	9.03	80
	10.35	9.50	7.79	α –tocopherol average

L.S.D value at 0.05 . level

Interaction between black cumin extract and alpha-tocopherol	α -tocopherol concentration mg.L^{-1}	Concentration of soaked black cumin extract g. liter^{-1}
0.43	**0.25**	**0.25**

leaf area (cm2)

The results in Table (5) showed that spraying with vitamin α-tocopherol had a significant effect on the leaf area, where the plants significantly excelled when sprayed with this vitamin at a concentration of 120 mg.L -^{1}in a leaf area of 266.5 cm² compared to the leaf area of plants treated with the same vitamin but the concentration of 60 mg.L^{-1} and control plants which amounted to 176.9 and 148.0 cm², respectively. The reason may be due to the role of α-tocopherol in activating the enzymes responsible for the photosynthesis process and increasing the growth of the root system, which is a center for the production of plant hormones, including auxins and cytokinins, which have a clear impact on the strength of vegetative growth represented by the leaf area (Mohammed and Al-Younis, 1991.(Vitamins increase the activity of reactions by affecting enzymes, and their entry into the content of plant parts leads to the expansion of leaf cells and an increase in their number, thus increasing the total leaf area (Eid etal 2010). This result is consistent with what was found by (Sultani etal 2012) on the chrysanthemum plant and Ali (2020) in her study on the senna plant .Table (5) indicates that spraying with black cumin extract at a concentration of 80 g.l $^{1-}$had a significant effect in increasing the total leaf area, which amounted to 280.5 cm², compared to plants sprayed with the same extract at a concentration of 40 g.l. for the control plants. Its leaf area was 174.3 and 136.7 cm², respectively. The reason for this may be due to the fact that the extract contains nutrients that lead to an increase in the metabolic activities of the plant, including potassium, which is necessary for the formation of amino acids and protein.It also helps in the synthesis of chlorophyll important in the process of photosynthesis and the formation of sugars, proteins and energy compounds ATP, which all affect vegetative growth represented by increasing leaf area (2003, O'Dell .(The interaction between spraying with α -ocopherol and the extract of soaked seed had a significant effect on the leaf area, where the plants treated with A -ocopherol at a concentration of 120 mg.l $^{1-}$with the extract of soaked seed at a concentration of 80g.l gave the largest leaf area of 371.4 cm² compared to the lowest leaf area of 35.5 cm² was the control plants.

Table (5) Effect of spraying with A -ocopherol and extract of black cumin soaked and the interaction between them on the leaf area (cm²) of freesia plant.

soked black cumin extract average	α -tocopherol concentration mg.L¹-			Concentration of soaked black cumin extract g. liter¹-
	120	60	0	
136.7	211.9	162.6	35.5	0
174.3	216.1	174.6	132.1	40
280.5	371.4	193.5	276.5	80
	266.5	176.9	148.0	α –tocopherol average

L.S.D value at 0.05 . level

Interaction between black cumin extract and alpha-tocopherol	α -tocopherol concentration mg.L¹-	Concentration of soaked black cumin extract g. liter¹-
12.15	7.02	7.02

Flowering traits:

1- Vase life (day)

The results in Table (6)showed that spraying plants with vitamin α-tocopherol had a significant effect on the vase life .The plants treated with this vitamin at a concentration of 120 mg.l primrose at the time of flowering, as it needed 98.22 days compared to those plants treated with α-tocopherol, but at a concentration of 60 mg.L^{-1}, and the control plants needed 104.78 and 109.33 days, respectively, to flower. Perhaps the reason for reducing the number of days required for plants to flower when sprayed with α-tocopherol is due to its role in increasing the activity of the photosynthesis process as a result of increasing the leaf area and increasing the content of leaves from chlorophyll, which together increase the production of carbohydrates and that these substances accelerate the development and maturity of inflorescences and then early flowering or

the reason for this may be attributed to the fact that this excelled is due to the role of potassium in activating the flowering process. Abu Dahi and Al-Younis (1988). As well as the role of nitrogen in the balance of the ratio of carbon to nitrogen in a plant, and this depends on it in the process of emergence and growth of the principles of flowers (1979, Adams and Winsor). These results are similar to those of Ali (2020) on the senna plant.

Table (6) shows the signifacnt effect of spraying with black cumin extract infused at vase life of plants.

soked black cumin extract average	α -tocopherol concentration mg.L^{1-}			Concentration of soaked black cumin extract g. liter^{1-}
	120	60	0	
107.22	97.67	101.00	123.00	0
105.11	99.67	114.33	101.33	40
100.00	97.33	99.00	103.67	80
	98.22	104.78	109.33	α –tocopherol average

L.S.D value at 0.05 . level

Interaction between black cumin extract and alpha-tocopherol	α -tocopherol concentration mg.L^{1-}	Concentration of soaked black cumin extract g. liter^{1-}
2.29	1.32	1.32

As the plants sprayed with this extract at a concentration of 80 and 40 g.l^{1-} had early flowering, as it needed 100.00 and 105.11 days compared to the control plants, which needed 107.22 days to flower. The reason for this may be due to the increase in the content of nutrients absorbed by the plant, which affects the activity and increase the efficiency of photosynthesis and the transmission of its products to the plant parts and thus led to the early emergence of inflorescences.and that spraying with black cumin extract soaked led to the early opening of flower buds, it may be

attributed to the fact that it contains many amino acids, which are the building unit of proteins that can be enzymes that have a major role in the cell division of the top of the branch, leading to a change in the shape and size of the tops and turning them into tops or the flower buds instead of the vegetative buds to become places of high metabolic activity to attract carbohydrates manufactured in these flowering buds for the purpose of their final distinction for the emergence of the flower parts, which was positively reflected on the reduction in the number of days required for flowering (Saleh et al., 1980).The bi-interaction between spraying with alpha-tocopherol and spraying with black cumin extract infused had a significant effect on vase life.The plants sprayed with vatocopherol at a concentration of 120 mg.l^{1-} and black cumin extract at a concentration of 80g.l^{1-} were distinguished for their earlier vase life, which required 97.33 days, compared to the control plants, who required 123.00 days for flowering.

Table (6) Effect of spraying with α-tocopherol and extract of black cumin soaked and the interaction between them on vase life (day) of freesia plant.

soked black cumin extract average	α -tocopherol concentration mg.L^{1-}			Concentration of soaked black cumin extract g. liter^{1-}
	120	60	0	
48.89	58.00	51.67	37.00	0
59.78	68.33	62.67	48.33	40
63.78	74.00	64.00	53.33	80
	66.78	59.44	46.22	α –tocopherol average

L.S.D value at 0.05 . level

Interaction between black cumin extract and alpha-tocopherol	α -tocopherol concentration mg.L^{1-}	Concentration of soaked black cumin extract g. liter^{1-}
1.58	0.91	0.91

2- Duration of flowering (day)

Table (7)showed that spraying freesia plants with vitamin α-tocopherol has a significant effect on the flowering period, The plants that were sprayed with α -ocopherol at a concentration of 120 mg.L^{-1} had the longest flowering period of 66.78 days, compared with the shortest period of 59.44 and 46.22 days, for plants treated with the same vitamin, but at a concentration of 60 mg.L^{-1} at the same time, the plants treated with a concentration of 60 mg.L^{1-} in the period of flowering excelled on the control plants. Spraying with alpha-tocopherol led to a prolongation of the flowering period of the plant. The reason is that these treatments increased the efficiency of the photosynthesis process and the production of carbohydrates and as a result of improving the vegetative traits represented by increasing the number of leaves and leaf area and increasing the number of roots, which was reflected positively in prolonging the flowering period or, the reason may be due to the increase in food manufacturing processes and its accumulation in the plant and its transfer to flowers as centers for attracting metabolic products, which was positively reflected in the prolongation of the flowering period (Al-Abdali, 2011). This result is consistent with what Ali (2020) found on the senna plant.Table (7) shows that spraying plants with black cumin extract has a significant effect on the flowering period .The plants sprayed with this extract at concentrations of 80 and 40 g/l significantly excelled their flowering period of 63.78 and 59.78 days compared to the shortest flowering period of 48.89 days for the control plants.The reason for this may be due to the fact that the drenched black cumin extract contains a percentage of nutrients as well as vitamins and amino acids, as it improves the characteristics of vegetative growth represented by increasing the number of total leaves and leaf area, and this was reflected positively in prolonging the flowering period (Abdel-Nasser and Saad El-Din, 2013) Also, the interaction between spraying with α-tocopherol and the extract of soaked black cumin had a significant effect on the flowering period, as the plants treated with α-tocopherol at a concentration of 120 mg.l^{1-} and the extract of soaked black cumin at a concentration of 80g.l^{1-} were distinguished by the longest flowering period of 74.00 days compared to the control plants, whose flowering period was 37.00 days .

Table (7) Effect of spraying with α-tocopherol and extract of black cumin soaked and the interaction between them on flowering period (day) of freesia plant.

soked black cumin extract average	α -tocopherol concentration mg.L^{1-}			Concentration of soaked black cumin extract g. $liter^{1-}$
	120	60	0	
34.33	41.00	38.00	24.00	0

36.33	**39.33**	**33.67**	**36.00**	**40**
42.78	**47.33**	**39.00**	**42.00**	**80**
	42.55	**36.89**	**34.00**	**α –tocopherol average**

L.S.D value at 0.05 . level

Interaction between black cumin extract and alpha-tocopherol	**α -tocopherol concentration mg.L^{1-}**	**Concentration of soaked black cumin extract g. liter^{1-}**
2.33	**1.35**	**1.35**

3- The number of florets (floret.inflorescence $^{-1}$)

It is noted from Table (8) that spraying plants with the vitamin A -tocopherol has a significant effect on the number of florets, as the plants that were sprayed with this vitamin at a concentration of 120 mg.L^{-1} were distinguished in forming the largest number of florets in the inflorescence, which amounted to 42.55 floret.inflorescence $^{-1}$.Compared to the lowest number of florets, it was 34.00 floret.inflorescence $^{-1}$ of the control plants, and the concentration of 120 mg.l^{1-} excelled on the concentration of 60 mg.l^{1-} of the same vitamin in the trait of the number of florets. The reason for this may be attributed to the entry of vitamins into all enzymatic activities and the increase in biological activities and photosynthesis processes. Which results in an increase in vegetative growth and the production of amino and nucleic acids, which positively affects the construction of carbohydrates and their transfer from the places of manufacture to the rest of the plant, thus creating a state of balance between carbohydrates and protein, which is reflected in the differentiation of flower buds and the increase in the number of florets (Abdul Hamid and others, 1993).or, the reason may be due when spraying plants with α -ocopherol to a cycle in encouraging vegetative growth represented by increasing the number of leaves and leaf area, increasing processed carbohydrates and transferring them to vegetative buds and transforming them into flower buds. And Abdul Latif et al. (2016) on the ostomy plant and Ali (2020) on the senna plant.Table (8) indicates that spraying with black cumin infused extract had a significant effect on the number of florets, as plants sprayed with black cumin infused extract at a concentration of 80 g.L-1 significantly excelled in forming the largest number of florets, which amounted to 42.78. floret.inflorescence $^{-1}$ compared to the lowest number of florets, 36.33 and 34.33. floret.inflorescence $^{-1}$was for plants sprayed with the same extract and for control plants, respectively Where the number of florets increased by increasing the concentration of the extract.

The reason may be due to the fact that the extract of soaked black cumin contains many macro and micro nutrients and increases its readiness for the plant and its transfer to the vegetative parts, which led to an increase in the efficiency of vital activities in the vegetative total of the plant, which reflected positively on the efficiency of the photosynthesis process and food processing, which stimulates growth and increase The number of florets (Mohamed and Younes, 1991)or the reason may be due to the increase in the number of leaves and leaf area, which led to an increase in the materials resulting from the photosynthesis process and then their transfer to the consumable parts represented by the flowers, and then increasing their number (Nasim, 2009). As for the bi-interaction between the two factors of the study, the plants sprayed with A -ocopherol at a concentration of 120 mg.l^{1-} and the extract of soaked black cumin at a concentration of 80g.l^{1-} gave the largest number of florets, amounting to 47.33 florets. Inflorescence $^{1-}$ compared to the lowest number of florets, the comparison plants had 24.00 floret.inflorescence

Table (8) Effect of spraying with alpha-tocopherol and black cumin extract and the interaction between them on the number of florets (floral inflorescence $^{1-}$) of freesia plant.

soked black cumin extract average	α -tocopherol concentration mg.L^{1-}			Concentration of soaked black cumin extract g. liter^{1-}
	120	60	0	
34.33	41.00	38.00	24.00	0
36.33	39.33	33.67	36.00	40
42.78	47.33	39.00	42.00	80
	42.55	36.89	34.00	α –tocopherol average

L.S.D value at 0.05 . level

Interaction between black cumin extract and alpha-tocopherol	α -tocopherol concentration mg.L^{1-}	Concentration of soaked black cumin extract g. liter^{1-}
2.33	1.35	1.35

4- The flower stalk length (cm)

Table (9) indicates that spraying with alpha-tocopherol had a significant effect on the length of the flower stalk. The results showed that the plants sprayed with alpha-tocopherol at a concentration of 120 and 60 mg.l^{1-} did not significantly differ between them in the flower stalk length which was 18.59 and 18.22 cm, respectively. However, they significantly excelled the flower stalk of the control plants, which was 15.85 cm. The reason may be due to the role of vitamins in protecting cell membranes and chloroplasts, where they are antioxidants that preserve plant cells from premature aging and stimulate cell division and elongation, causing an increase in the flower stalk length(Bender 2003).or, the reason may be due to the similarity of this vitamin with the hormonal properties of plants from its presence in the growing peaks and meristem areas such as auxins, leading to cell division and elongation, as well as to its formation of many hormonal compounds and enzymes that increase the activity and stimulate the plant to grow, which leads to the formation of better vegetative growth and then Producing longer branches, which was positively reflected in the increase in the flower stalk length (Hopkino and Muner 2008, 2008).). These results are in agreement with what was found (Badawy, 2015) on Antirrhinum majus plant.While Table (9) shows the significant effect of spraying with black cumin extract infused on the length of the flower stalk , the results showed the excelled of plants that sprayed with black cumin extract infused at a concentration of 80 g.l $^{1-}$ significantly in the length of flower stalk, which reached 18.15 cm over the control plants.The average flower stalk length was 16.85 cm. The reason for the increase in the flower stalk length treated with black cumin extract soaked may be due to its high content of nitrogen compounds and other elements sufficient to meet the needs of the plant during the two processes of cell division and elongation, especially since nitrogen is included in the composition of proteins and nucleic acids DNA and RNA, which encourages the elongation of flower stalk(Al-Tamimi, 2001; 2006, Zeiger and Tais). The bilateral interaction between spraying with alpha-tocopherol and black cumin soaked extract had a significant effect on the length of the inflorescence. The plants that sprayed with alpha-tocopherol at a concentration of 120 mg.l^{1-} and black cumin drenched extract at a concentration of 80g.l^{1-} were distinguished by the longest inflorescence of 19.89 cm compared to the shortest flower stalk length that reached 15.00 cm. The plants were compared.

Table (9): Effect of spraying with alpha-tocopherol and black cumin soaked extract and the interaction between them on the flower stalk length (cm) of freesia plant.

soked black seed extract average	α -tocopherol concentration mg.L^{1-}			Concentration of soaked black seed extract g. liter^{1-}
	120	60	0	
16.85	17.78	17.78	15.00	0

17.67	**18.11**	**18.45**	**16.45**	**40**
18.15	**19.89**	**18.44**	**16.11**	**80**
	18.59	**18.22**	**15.85**	**α –tocopherol average**

L.S.D value at 0.05 . level

Interaction between black seed extract and alpha-tocopherol	**α -tocopherol concentration mg.L^{1-}**	**Concentration of soaked black seed extract g. liter^{1-}**
1.49	**0.86**	**0.86**

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