PHYSIOLOGICAL EFFECTS OF AMINO ACIDS AND ASCOPPIN ON ROWTH,YIELD AND CHEMICAL COMPOSITION OF THE CORIANDER(CORIANDRUM SATIVUM L.) PLANTS

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ABSTRACT:

This study was conducted in Research Station Horticultural Sides- Horticultural Research Institute Agricultural Research Center during the seasons 2011/2012 and 2012/2013 to study the response of the vegetative growth, yield and percentage of components and oil pilot plants coriander under the conditions of the region Middle Egypt, amino acids (compound strong amino gold) and composite ascoppin or combined with four different concentrations of the compound strong amino gold (0- 100- 150- 200 g/100 liters of water) with a compound ascoppin different concentrations (0- 150- 200 -250 g/100 liters of water) with fertilizing coriander half the recommended amount of fertilizer mineral with both transactions foliar (both composite strong amino gold or composite ascoppin) improved significantly where there was a positive effect in recipes vegetative growth of different such as high plant and stem diameter and weight of dry herb/plant was the best transactions these attributes are resulting from treatment (150 g of compound strong amino Gold with 150 grams of a compound ascoppin) both in a single case or in the case of overlap, as compared to the standard and there was a clear improvement and moral in the properties of crop plants coriander , a number of fruits per plant and the amount of seed yield per plant and acre , as well as the percentage of the components of oil using a concentration of 200 g of the compound strong amino Gold with 150 to 200 grams of a compound ascoppin where gave the best results and interaction between them vegetative growth and yield components and chemical properties therefore recommends from the economic point of view under treatment plants coriander compound strong amino gold concentration of 200g with a compound ascoppin concentration of 200g/100 liters of water and it sprayed the plants three times begin after planting a month and a half, and at intervals of every three weeks in order to improve vegetative growth and yield components and the percentage of the components of the volatile oil .

Key words: Coriander - Amino acids – Ascoppin - Seed yield - Essential oil - GC-MS.

INTRODUCTION

Coriander (*coriandrum sativum* L.) is one of the most important of vegetables, spices and medicinal plant. It is an annual and herbaceous plant, belonging to the Apiaceae family. The coriander seeds have essential oil as an active substance, which is used in Pharmaceutical industry as a antispasmodic and a carminative (**Diederichen, 1996 and Carrubba *et al*., 2002)**.Applying of biofertilizers, organic and foliar fertilizers led to a decrease in the use of chemical fertilizers and has provided high quality products free of harmful agrochemicals for human safety **(Salem and Awad, 2005 and Mahfouz and Sharaf Eldin, 2007)**. In Egypt, it is mainly grown in Egypt Governorates like Beni-Suef, Minia and Assiut as a winter annual herb. The seeds of coriander plants contain 0.2–1.0% volatile oil which contains (65- 70% linalool (coriandrool) and pinene. It is used as a flavor for meats, canned foods, spicy, sauces, backed goods, confectionery and perfumes (**Khattab and Helmy, 2002**).In addition, coriander stimulates the flow of digestive secretion which is useful as carminative and laxative and in the treatment of intestinal disorders and has antispasmodic and expectorant properties (**Bedoukian, 1967 and Stary and Jirasck, 1975**).

Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins, **Davies (1982)**. Amino acids are particularly important for stimulation cell growth. They act as buffers which help to maintain favorable pH value within the plant cell, since they contain both acid and basic groups; they remove the ammonia from the cell. This function is associated with amide formation, so they protect the plants from ammonia toxicity. They can serve as a source of carbon and energy, as well as protect the plants against pathogens. Amino acids also function in the synthesis of other organic compounds, such as protein, amines, purines and pyrimidiens, alkaloids vitamins, enzymes, terpenoids and others, Tyrosine is hydroxyl phenol amino acid that is used to build neurotran smitters and hormones. Several other authors indicated that promotive effect of amino acids on ornamental and medicinal plants including, **Abou Dahab and Abdel-Aziz (2006)** on *Philodendron erubescens*.

Ascoppin (Ascorbic and Citric acid) acts as coenzyme reaction by which carbohydrates, fats and protein and metabolized. Vitamin C led to increase nucleic acid content especially RNA. **Smirnoff and Wheeler (2000)** reported that ascorbic acid is an abundant component of plans. It reaches a concentration of over 20 m M in chloroplasts and occurs in all cell compartments including cell wall. It has proposed functions in photosynthesis, as an enzyme cofactor, **Abdel-Aziz *et al*., (2006)** on *Khaya senegalensis* indicated that application of ascorbic acid significantly increased all growth parameters as well as some chemical constituents.

At the present time, there is a national and international interest in increasing the area cultivated with medicinal and aromatic plants by the use of organic agriculture. Therefore, the present study aimed to figure out the most suitable treatment among amino acids and antioxidants. So, we can minimize or eliminate the application of expensive mineral fertilizers and lead to considerable decrease in production cost. In addition, lowering the pollution rate in soil, water and air as a result of reducing the extensive use of chemical fertilizers, along with improving vegetative growth, seed yield and volatile oil of coriander (*Coriandrum sativum*, L.) **Galal and Ali (2004)** reported that the term organic agriculture respectful of the environment from the production stages through handling and processing. Organic agriculture is based on minimizing the use of external inputs and avoiding the use of synthetic fertilizers and pesticides.

MATERIALS AND METHODS

A filed experiment was conducted during the two successive seasons of 2011/2012 and 2012/2013 in the Experimental Farm of Horticultural Research Station at Sides, Agricultural Research Station at Sid, Agricultural Research Center, Beni Suef Governorate. The aim of this study was to explore the response of *Coriandrum sativum*, L. plants to foliar application of Amino acids (Strong amino gold) a commercial product contains 14 kinds of amino acids in the form of ascoppin (ascorbic and citric acids), spray on the plant base at stem elongation stage. Several soil samples

(0-40 cm depth) were taken for the nutrient and trace element analysis prior to land preparation.

Table (A):Chemical and physical properties of the experimental soil.

Characters	Value	Character	Value
Soil type	Clay soil	Avail N+ ppm	**40**
Clay %	53.3	Avail. P+ ppm	18
Silt %	36.2	Avail. K+ ppm	336
Sand %	10.5	Fe ppm	2.40
Org. Matt. %	2.23	Mn ppm	0.60
$CaCO_3$ %	3.20	Zn ppm	0.20
PH (1 : 2.5)	7.60	Cu ppm	2.00
E.C. (m/mhos/cm)	0.90	---------------------------	-------
Exchange K+(meq/l)	0.8	Exchange SO4--(meq/l)	7.5
Exchange Ca++(meq/l)	4.0	Exchange Cl-(meq/l)	1.0
Exchange Na+(meq/l)	2.7	Exchange HCO3- (meq/l)	1.0
Exchange Mg++(meq/l)	2.0	Exchange CO3- -(meq/l)	-----

Table (B) Chemical analysis of compound Strong amino gold (N 20% w/w Free amino acid 49% w/w):

Glutamic	**Serine**	**Arginine**	**Treonine**	**Proline**	**Leucine**	**Glycine**	**Tyrosine**
8.02%	5.82%	5.08%	3.78%	3.44%	3.16%	2.91%	0.63%
Aspartic	Valine	Alanine	Lisine	Phenilalanine	Isoleucine	Histidine	Methyonine
2.70%	2.30%	2.27%	1.49%	1.41%	1.09%	0.68%	0.39%

Seeds of coriander plants, for experiment, were sown on1st of November in the two seasons. Each experimental plot was 3.0 m long with the spacing of 60 cm between the rows and 30cm between hills. So, each plot contained 5 rows and 50 hills. There was a space of one meter between the plots. Coriander seeds were directly sown by hand in soil. After one month from sowing, the plants were thinned to (2) plants per hill. There was no incidence of pest or disease on coriander during the experiment. All other agricultural practices were followed as usual.

Split- plot design was also used in this experiment where the main plots were occupied by four treatments of (strong amino gold) compound while sub- plots were assigned to four treatments of (ascoppin) compound. Strong amino gold was applied at the rate of (0-100-150-200 g/100 l.) while, ascoppin was applied at the rate of (0-150-200-250 g/100 l.) were foliar sprayed three times, after thinning and after 3 weeks thereafter, however, 24 hours were allowed between the addition of each treatments. In addition, all experimental units, including control, received half rate of the recommended rate according to **A. R. C., 2005** of ammonium sulphate (150kg/fed.) One half of these amounts were applied on the 1st of December (after one month from sowing date), while the other half was applied after one month from the first dose in both seasons., P at 200 Kg of calcium super phosphate (15.5% $P_2 O_5$) was added before sowing date, while K at 50 Kg K_2O fertilizer as potassium sulphate (48% K_2O) was added in two equal doses, at the beginning of flowering stage and the second one was added three weeks later. The plants were harvested on the third week of April in both seasons.

The following data were recorded:

Vegetative growth characters:

Plant height (cm).
Stem diameter (mm).
Dry herb/ plant (g).

Yield and yield component parameters:

Number of umbels/ plant.
Weight of 100 fruits (g).
Fruit yield/ plant and fed.

Chemical constituents:

Herb nitrogen percentage.
Herb phosphorus percentage.
Herb potassium percentage.

Volatile oil determinations:

Volatile oil percentage.
Volatile oil yield per plant/fed
Volatile oil analyzed by GC/MS

Statistical analysis:

Data were statistically analyzed according to **MSTAT_C (1985)** program using 2 factor C models – 9; the differences between means were tested by using the least significant differences (**L.S.D**) test**.** Experiment, for the two successive seasons, terminated during the third week of April when different vegetative growth characters and yield and yield components were measured and weighted. Extraction of coriander fruits essential oil according to **Guenther (1961)**, Determination of essential oil percentage according to **A.O.A.C. (1996)**, analyzed GC/MS by **Assis and Lancas (1999)** and herb nitrogen, phosphorus and potassium percent were determined according to **Page *et al*., (1982**).

RESULTS and DISCUSSION

Effect of Amino acids and Osco pin treatments on coriander plants:

A - Vegetative growth traits:

Plant height:

Both treatments of amino acids produced significantly taller coriander plants, in both seasons, than those of control untreated plants., The highest values concerning plant height were resulted from the application of amino acids at 200 followed by 150 g/100 l. which increased plant height over the control by 10.2 and 9.7% in the first season and by 12.9 and 11.6 % in the second one, respectively., while no significant difference between them, while there are significant differences between them and low concentration treatment, amino acids was reported to increased plant height as reported by **Shehata *et al*.,(2011)**on reported that amino acids including methionine and cystine at 500 and 750 ppm. on celeriac plant spraying the plants with amino acids at the high rate significantly increased plant height compared to control. **Hendawy and Ezz El–Din (2010)** tested the response of fennel plants (*Foeniculum vulgare*) to amino acids aspartic and phenylalanine at the rates of 100, 200 or 300 ppm. each and concluded that amino acids treatments increased plant height in comparison to untreated control plants., **El–Zohiri and Asfour (2009)** on potato found that spraying amino acids at 0.25ml/l. significantly increased vegetative growth expressed as plant height. **Sarojnee *et al*., (2009)** examined the response of hot pepper (*Capsicum annum*, L.) plants to two sources(formulations) of amino acids i.e. powder at 0.27 and 0.45 g per plant and liquid at 1.0 and 1.6 ml / l. and found that amino acid treatments produced significant increase in plant height compared to control plants.

It is clear from the obtained data that using ascoppin at 200 to 250 g/100 l. significantly improved plant height rather than control treatment., never the less the first season were no significant differences between the second and the third concentration, while in the second season there was a significant differences among them., the application of ascoppin at 200g/100 l. increased plant height over the control by 3.4 and 6.9% in the first and second seasons, respectively., number of researchers pointed out the effective role of ascoppin in stimulating plant height of coriander. The results agreed with those stated by **Bardisi (2004)** treated garlic plants with ascorbic acid at 100 or 200 ppm. found that ascorbic acid at 100 or 200 ppm. gave the maximum values of plant height. **Ismail (2004)** indicated that citric acid at 0.75 g/l. on *Beaucanea recurvata* showed highly significant increment in plant height and **Mohamed and Naguib (2002)** on reported that foliar application of ascoppin alone or combined with potassein (P) or potassein (N) on fenugreek plants gave significantly increased plant height.

Table (1): Effect of amino acids and ascoppin treatments on plant height (cm) of coriander plant during the 2011 and 2012.

Amino acids treatments (strong amino gold)	Ascoppin treatments				
	Control	150g/100 l.	200g/100 l.	250g/100 l.	Mean(A)
	First season				
Control	92.73	96.88	95.40	98.20	95.80
100 g/100 l.	99.45	100.3	99.50	103.9	100.8
150 g/100 l.	102.5	103.2	107.9	106.7	105.1
200 g/100 l.	102.5	106.5	108.1	108.3	106.4
ean(B)	**99.29**	**101.7**	**102.7**	**104.3**	
LSD 5%	A:3.4	B:2.9	AB:5.8		
	Second season				
Control	92.60	94.33	94.70	99.80	**95.36**
100 g/100 l.	95.73	106.9	102.3	106.5	**102.9**
150 g/100 l.	99.10	104.7	111.8	109.6	**106.3**
200 g/100 l.	103.6	108.9	109.3	108.6	**107.6**
Mean(B)	**97.75**	**103.7**	**104.5**	**106.1**	
LSD 5%	A: 3.4	B:2.7	AB:5.9		

The interaction between amino acid and ascoppin treatments was significant in the two seasons as clearly declared in Table (1). Compared with LSD 5% the best results were obtained due to the amino acid 150g plus ascoppin 200g/100l. in the first and second seasons, in comparison with control pants.

Stem Diameter:

Table (2) shows that amino acids(strong amino gold compound) treatments resulted, a significant thicker stems of coriander plants than those of control plants in both seasons., among such one stimulant treatment amino acids were effective 150 g/100 l., treatment which increased stem diameter over the control by 28.6 and 31.7 % in the first and second one, respectively. The role of amino acids in stimulating stem diameter was reported by **Yassen *et al*.(2010)** concluded that spraying of tryptophan at the rates of 25 and 50 ppm. on anise plants (*Pimpinella anisum*) plus two nitrogen forms (ammonium nitrate or ammonium sulphate) resulted in an increase of stem diameter compared with untreated plants and **Abd El -Aziz *et al*.,(2010)** investigated the response of *Thuja orientalis* plants to foliar application of tyrosine, thiamine and tryptophan each at 25, 50 and 100 ppm. and found that vegetative growth expressed as stem diameter was significantly promoted due to amino acid treatments compared to untreated control plants.

Concerning the ascoppin treatments, all rates, in the two seasons, resulted in a significant increment in stem diameter of *Coriandrum sativum* plants than those of untreated plants as shown in Table (2). Among the three ascoppin treatments no significant difference between them in both seasons. Treating the plants with ascoppin at 150 g/100 l. gave the maximum values of stem diameter over the control by 16.7 and 16.9 % in the first and second seasons, respectively. Harmony results were pointed out by **Helal *et al*.,(2005)** stated that foliar spray with vit. C at 200 ppm. significantly increased the number of leaves/plant of pea *(Pisum sativum)* plants, **Milad and Mohamed(2009)** investigated the effect of foliar spray of citric acid at 75, 150 and 300 ppm. on marigold plants(*Calendula officinalis* L.) and found that there was a significant increase in stem diameter as compared to control treatment. and **Nour *et al*., (2012)** applied citric acid at 0.25 and 0.50 % on snap bean plants and found that foliar spray of citric acid led to a significant increment of stem diameter per plant as compared to control treatment. They added that the high concentration of citric acid was more effective than the low concern.

The investigated interaction had a significant effect on stem diameter of coriander plants. Spraying the plants with amino acids at 150 g/100 l. in combination with ascoppin 200g/100 l. gave the maximum values of stem diameter., these results were true in the two growing seasons as clearly shown in Table (2).

Table (2): Effect of amino acids and ascoppin treatments on stem diameter (mm) of coriander plant during the 2011and 2012.

Amino acids treatments (strong amino gold)	Ascoppin treatments				
	Control	150 g/100 l.	200g/100 l.	250 /100 l.	Mean (A)
	First season				
Control	13.5	15.4	12.5	11.8	**13.3**
100 g/100 l.	12.6	15.9	16.1	15.9	**15.1**
150 g/100 l.	14.6	16.6	18.2	18.9	**17.1**
200 g/100 l.	14.5	16.6	17.5	18.2	**16.7**
Mean(B)	**13.8**	**16.1**	**16.1**	**16.2**	
LSD 5%	A: 0.8	B:0.6	AB:1.3		
	Second season				
Control	13.2	15.6	14.1	12.7	**13.9**
100 g/100 l.	14.6	17.5	15.3	16.1	**15.9**
150 g/100 l.	15.7	17.9	19.6	19.9	**18.3**
200 g/100 l.	15.7	18.1	18.7	18.6	**17.8**
Mean(B)	**14.8**	**17.3**	**16.9**	**16.8**	
LSD 5%	A: 0.9	B:0.5	AB:1.3		

Herb dry weight/plant:

Obtained data in Table (3)showed a significant differences between both amino acids treatments, and control treatment in both seasons. Concerning amino acids treatments, application of amino acids at 150 to 200g/100 l. was significantly preferable than using the other treatment. The highest value was detected due to the application of dual amino acids treatment (150g/100 l.) in the two seasons compared with control. In this regard, these one amino acid concentration produced the heaviest dry weight which reached 15.7 and 14.2% in the first and second seasons, respectivelly. In accordance with these results, concerning amino acids, **Gamal El–Din and Abd El–Wahed (2005)** proved that amino acid treatments significantly increased fresh and dry weights of chamomile plants as compared to control, **Saeed *et al*., (2005)** on soybean plant, found that the treatment of amino acids significantly improved growth parameters of shoots and fresh weight. **Abou Dahab and Abd El–Aziz (2006)** concluded that amino acid application significantly increased dry weight of leaves and stems of *Philodendron erubescens* plants over the untreated plants, **El–Zohiri and Asfour (2009)** on potato found that spraying amino (formulations) of amino acids i.e. powder at 0.27 and 0.45 g per plant and liquid at 1.0 and 1.6 ml / l. and found that amino acid treatments produced significant increase in shoot dry matter as compared to control plants. **Sarojnee *et al*., (2009)** examined the (formulations) of amino acids i.e. powder at 0.27 and 0.45 g per plant and liquid at 1.0 and 1.6 ml / l. and found that amino acid treatments produced significant increase in number of branches per plant and shoot dry matter as compared to control plants and **Rahmatzadeh *et al*., (2012)** on *Catharanthus roseus*, recorded that the application of tryptophan at 150, 250 and 350 ppm. led to a significant promotion of fresh and dry weights of shoots /plant in comparison with untreated plants.

Table(3):Effect of amino acids and ascoppin treatments on herb dry weight/plant(g)of coriander plant during the 2011 and 2012.

Amino acids treatments (strong amino gold)	Ascoppin treatments				
	Control	150 g/100 l	200 /100 l.	250 /100 l.	Mean(A)
	First season				
Control	44.1	50.6	49.5	49.9	**48.5**
100 g/100 l.	47.9	53.4	53.9	57.7	**53.2**
150 g/100 l.	51.7	56.4	56.8	59.6	**56.1**
200 g/100 l.	51.7	56.2	57.9	59.2	**56.3**
Mean(B)	**48.9**	**54.2**	**54.5**	**56.6**	
LSD 5%	A :2.8	B:2.5	AB:5.1		
	Second season				
Control	45.5	51.3	50.1	50.5	**49.4**
100 g/100 l.	49.6	54.8	55.3	57.6	**54.3**
150 g/100 l.	51.1	56.3	59.2	59.1	**56.4**
200 g/100 l.	51.3	55.6	58.9	58.9	**56.2**
Mean(B)	**49.4**	**54.5**	**55.9**	**56.5**	
LSD 5%	A:2.9	B :2.7	AB:5.1		

Table (3) shows that both three ascoppin rates significantly increased herb dry weight per plant compared with non-application. While there was no significant differences between the three rates used in both seasons, respectively. In this regard, ascoppin (150g/100 l.) produced the heaviest dry weight which reached 11.5 and 13.2 % for dry weight in the first and second seasons over control, respectively. In agreement with these results those obtained on coriander **Noor El–Deen (2005)** on marjoram (*Majorana hortensis*, M.) mentioned that spraying the plants with citric acid at 75 ppm. promoted the herb fresh and dry weights. **Abd El-Al (2009)** mentioned that citric acid at 500 ppm. significantly augmented the vegetative growth traits of sweet pepper plants i.e. shoots and fresh and dry weighs of leaves, shoot and whole plant compared to control treatment and **Kenway (2010)** supplied *Ammi visnaga* plants with ascorbic acid at 200 ppm. and obtained an increase in herb dry weight per plant were greatly augmented in comparison with the control plants.

The interaction between amino acids and ascoppin treatments was significant in the two seasons. The highest overall results were obtained due to either amino acid in combination with ascoppin treatment (150g with 250g/100 l.) in the first season and (150g with 200g/100 I.)in the second season as illustrated in Table (3).

Yield and Yield Components:

Number of Umbels/ plant:

The obtained results in Table (4) show that amino acids treatment significantly produced more number of umbels/ plant than that of control plants. Moreover, concentration of 150 g/100 l. produced higher umbels number than of 150 g. These results were identical in both first and second seasons. Numerically, these one treatment augmented number of umbels/ plant by 14.3 and 10.3 % in the first and second seasons, respectively, in comparison with that of control plants. In harmony with these results the findings of **Yassen *et al*., (2010)** obtained heavier umbels dry weight from anise plants fertilized with ammonium sulphate and sprayed with amino acid tryptophan at 25 or 50 ppm. than those of untreated control plants, **Hendawy and Ezz El–Din (2010)** mentioned that amino acid treatments increased number of umbels of fennel plants as compared with control and **Hadi *et al*., (2011)** stated that amino acid treatments augmented the flowers number of chamomile plants.

Table(4):Effect of amino acids and ascoppin treatments on umbels /plant (g) of coriander plant during the 2011and 2012.

Amino acids treatments (strong amino gold)	Ascoppin treatments				
	Control	150 g/100 l.	200 g/100 l.	250 g/100 l.	Mean (A)
	First season				
Control	50.7	52.8	53.2	53.3	**52.5**
100 g/100 l.	51.7	53.3	55.0	55.0	**53.8**
150 g/100 l.	54.9	59.1	62.3	63.7	**60.0**
200 g/100 l.	55.1	60.0	63.5	64.1	**60.7**
Mean(B)	**53.1**	**56.3**	**58.5**	**59.0**	
LSD 5%	A: 1.6	B:1.3	AB:2.8		
	Second season				
Control	51.2	54.2	55.5	56.5	**54.4**
100 g/100 l.	53.9	54.7	57.0	59.1	**56.2**
150 g/100 l.	55.6	57.6	63.3	63.3	**60.0**
200 g/100 l.	55.6	59.8	63.3	64.4	**60.8**
Mean(B)	**54.1**	**56.6**	**59.8**	**60.8**	
LSD 5%	A: 1.9	B:1.7	AB:3.5		

In regard to antioxidant treatments (ascoppin), all of them in the two seasons resulted significantly in more number of umbels/ plant than those of untreated control plants as shown in Table (4). The most effective treatments, in ascending order, were 250 g/100 l. This trend proved to be true in the two seasons., but was found that there was no statistically significant relationship between concentration 250 and 200g/100 l.

which gave the highest increase in number of umbels/ plant 10.2 and 10.5% in the first and second seasons, comparing to untreated plants. In agreement with our results concerning antioxidants were those reported by **Abd El- Naeem (2008)** observed that using ascorbic acid foliar spray on caraway plants significantly improved number of umbels/ plant, number of umbellate/umbel and number of fruits/umbel. The treatment of ascorbic acid was the most beneficial treatment which resulted in the maximum values, **Tanious (2008)** found that using of ascorbic acid and salicylic acid on fennel plants significantly improved number of umbels/ plant, number of umbellate/ umbel/ plant, per plot and/fed. in comparison with the control. **Milad and Mohamed (2009)** tested the response of marigold plants (*Calendula officinalis*) to foliar spray of citric acid at 75, 150 or 300 ppm. and concluded that citric acid treatments increased fresh and dry weights of inflorescences in comparison with untreated plants and **Kenway (2010)** supplied *Ammi visnaga* plants with ascorbic acid at 200 ppm. and obtained an increase in number of umbels/ plant.

The interaction between amino acids(strong amino gold) and antioxidants (ascoppin) was significant in both seasons with the highest number of umbels/ plant being obtained due to strong amino gold(200 g) treatment in combination with the antioxidant ascoppin (250 g/100 l.) treatment as shown in Table (4) in the first and second seasons, respectively.

Weight of 100 Fruits:

Table (5) illustrated that strong amino gold treatments caused significant increase in both seasons, in weight of 100 fruits of coriander plants in comparison with control plants. The heaviest weight of 100 fruits was obtained by strong amino gold 200g followed by 150g; such two treatments increased the weight of 100 fruits giving similar values in the first and second season, respectively, as compared to control plants. The increase in weight of 100 fruits due to the (150 g/100 l.) rate over control treatment reached 53.7 and 43.1 % in the two seasons, respectively. On the line with these results concerning **Yassen *et al.*(2010)** obtained heavier umbels dry weight and higher seed yield from anise plants fertilized with ammonium sulphate and sprayed with amino acid tryptophan at 25 or 50 ppm., **Al–Qubaie (2012)** recorded that amino acids at 500 ppm. increased seed yield / plant, seed index and number of seeds/ and 100 seed weight of sunflower plant relative to check treatment and **Ahmed *et al.* (2011)** concluded that amino acids significantly augmented seed yield of rosella (*Hibiscus sabdariffa*) and 100 seed weight of rosella in comparison with control treatment.

Among the three effective antioxidant treatments, the highest treatment increased the weight of 100 fruits compared with control treatment, but has no significant differences between the high rate and the low rate in the first season and second seasons, respectively. The dual ascoppin treatment increased weight of 100 fruits at 150g/100 l. was 47.4 and 42.7 % in the first and second seasons, respectively, in comparison with untreated treatment. In agreement with our results concerning antioxidants were those reported by **Ismail (2008)** on *Nigella sativa* stated that application of ascorbic acid at 25 and 50 ppm. caused a marked increase in number of capsules and seed yield per plant especially at 50 ppm., while both concentrations of ascorbic acid decreased the weight of 1000 seeds. **Gahory (2012)** supplied black cumin plants with ascorbic acid at 150 and 200 ppm. each, as well as, their mixture.

The author obtained a significant increase in different yield and yield component characters such as number of capsules and weight of 100 seeds. He added that ascorbic acid at 200 ppm. gave the best results. **Tanious (2008)** found that using ascorbic acid on fennel plants significantly improved weight of 1000 fruits and fruit yield/ plant in comparison with the control treatment.

Table(5): Effect of amino acids and ascoppin treatments on weight of 100 fruits/plant(g) of coriander plant during the 2011and 2012.

Amino acids treatments (strong amino gold)	Ascoppin treatments				
	Control	150 g/100 l.	200 g/100 l.	250 g/100 l.	Mean(A)
	First season				
Control	2.55	3.50	3.65	3.70	**3.35**
100 g/100 l.	3.12	4.22	4.72	4.81	**4.22**
150 g/100 l.	3.45	5.61	5.72	5.83	**5.15**
200 g/100 l.	3.80	5.70	5.75	5.86	**5.28**
Mean(B)	**3.23**	**4.76**	**4.96**	**5.05**	
LSD 5%	A: 0.85 B:0.81 AB:1.63				
	Second season				
Control	2.62	3.54	4.20	4.30	**3.67**
100 g/100 l.	3.45	4.31	4.77	4.81	**4.34**
50 g/100 l.	3.60	5.73	5.82	5.83	**5.25**
200 g/100 l.	3.95	5.81	5.93	5.93	**5.41**
Mean(B)	**3.40**	**4.85**	**5.18**	**5.22**	
LSD 5%	A: 0.82 B:0.79 AB:1.60				

The interaction between amino acids and antioxidants was significant in the two seasons. The best results of the weight of 100 fruits were obtained due to treating coriander plants with strong amino gold (200g) in combination with the high antioxidants (250g/100 l.) treatment in the two seasons as illustrated in Table (5).

<u>Fruit yield per plant and per feddan:</u>

Fruit yield per plant and per fed. were significantly increased in both seasons, due to spraying coriander plants with strong amino gold in comparison with control plants. Among amino acids treatments, no significant differences was existed between highest rates in both seasons for fruit yield per plant, were 25.3 and 26.4 g/plant produced from treating plants with amino acids at the rates of 150 and 200 g/100 l. in the first season. The same trend was obtained in the second season. Whereas fruit yield of coriander per fed. were significantly augmented due to the medium and high concentration levels over those of the low level treatment. Therefore, the most effective level of amino acids, which gave the heaviest fruit yield/fed., was the treatment (200g/100 l.) these one treatment increased fruit yield/fed. in the first and second seasons respectively, as shown in Tables (6 & 7). In harmony with these results, **Yassen *et al*., (2010)** obtained heavier umbels dry weight and higher seed yield from anise plants fertilized with ammonium nitrate or ammonium sulphate and sprayed with amino acid tryptophan at 25 or 50 ppm. than those of untreated control plants. **Hendawy and Ezz El–Din (2010)** mentioned that amino acid treatments increased seed yield of fennel and **Ahmed et *al*., (2011)** concluded that amino acids combined with compost significantly augmented number of fruits / plant and seed yield of roselle (*Hibiscus sabdariffa*) in comparison with control treatment.

Table(6): Effect of amino acids and ascoppin treatments on fruit yield/plant (g) of coriander plant during the 2011and 2012.

Amino acids treatment (strong amino gold)	Ascoppin treatments				
	Control	150 g/100 l.	200 g/100 l.	250 g/100 l.	Mean(A)
	First season				
Control	18.9	21.0	21.1	21.5	**20.6**
100 g/100 l.	21.3	22.7	24.3	24.5	**23.2**
150 g/100 l.	23.9	24.1	26.9	26.1	**25.3**
200 g/100 l.	24.7	25.2	27.8	27.7	**26.4**
Mean(B)	**22.2**	**23.3**	**25.0**	**25.0**	
LSD 5%	A: 1.7	B:1.5		AB:3.3	
	Second season				
Control	20.3	22.3	23.2	22.7	**22.1**
100 g/100 l.	22.9	22.3	24.8	25.1	**23.8**
150 g/100 l.	24.7	25.2	26.8	27.0	**25.9**
200 g/100 l.	25.0	25.8	27.8	28.5	**26.7**
Mean(B)	**23.2**	**23.9**	**25.7**	**25.8**	
LSD 5%	A: 1.9	B:1.5		AB:3.3	

Table(7): Effect of amino acids and ascoppin treatments on fruit yield/fed.(kg) of coriander plant during the 2011and 2012.

Amino acids treatment (strong amino gold)	Ascoppin treatments				
	g/100 l.	150 g/100 l.	200 /100 l.	250 g/100 l.	Mean (A)
	First season				
Control	840.0	933.3	937.8	955.6	**916.7**
100 g/100 l.	946.7	1008.9	1080.0	1088.9	**1031.1**
150 g/100 l.	1062.2	1071.1	1195.5	1160.0	**1122.2**
200 g/100 l.	1097.8	1120.0	1235.5	1231.1	**1171.1**
Mean(B)	**986.7**	**1033.3**	**1112.2**	**1108.9**	
LSD 5%	A:65.1	B: 62.3	AB:125.1		
	Second season				
Control	902.2	991.1	1031.1	1008.9	**983.3**
100 g/100 l.	1017.8	991.1	1102.2	1115.5	**1056.7**
150 g/100 l.	1097.8	1120.0	1191.1	1200.0	**1152.2**
200 g/100 l.	1111.1	1146.7	1235.6	1266.7	**1190.0**
Mean(B)	**1032.2**	**1062.2**	**1140.0**	**1147.8**	
LSD 5%	A: 68.3	B: 63.5	AB:127.1		

Concerning antioxidant treatments, all of them caused significantly an increase, in both seasons, in fruit yield per plant and per fed. in comparison with those of untreated plants as shown in Tables (6 & 7). Among the four tested antioxidant treatments, 200g concentration was superior to the other treatments. The increase in fruit yield per plant and per fed. due to such superior treatments reached 12.6 and 12.7% in the first season and 10.8 and 8.5% in the second season, respectively, in comparison with control treatment. In agreement with these results were the findings revealed by **Helal *et al.*, (2005)** pointed out that the plant yield, and total yield per fed., as well as, the *Pisum sativum* were increased significantly with vit. C (at 200 ppm), **Al-Sharief (2006)** concluded that treating caraway plants with ascorbic acid and salicylic acid at 100, 200 and 300 ppm increased number of umbels/ plant and weight of fruits per plant and per fed. compared with control plants. **Abd El- Naeem (2008)** observed that using ascorbic acid as foliar spray on caraway plants significantly improved number of fruits/ umbel and weight of 1000 with the control., **Badran *et al*., (2011)** examined the response of fruit yield of coriander plants to antioxidants(ascorbic acids at 200 or 300 ppm.). The investigators found that all two treatments caused a noticeable increase in fruit yield per plant and per fed. However, the high concentration was found to be more effective than the low one and **Badran *et al*., (2013)** found that fruit yield per plant or fed. of coriander plants, grown in sand soil, were significantly increased due to the use of ascorbic acid at 300 ppm.

The interaction between amino acids and ascoppin treatments was significant in both seasons. The highest values of fruit yield per plant and per fed. was obtained due strong amino gold in combination with antioxidant treatment as clearly illustrated in Table (6 &7). These one superior combined treatments (strong amino gold at 200g with ascoppin at 200 or 250g/100 l.) gave the highest increase in fruit yield/plant and fed.

Volatile oil determinations:

Volatile oil percentage:

The obtained data in Table (8) show that strong amino gold treatments at 150 and 200g/100 l. significantly increased essential oil percentage in both two seasons compared to control. Numerically, the concentration of (150g/100 l.) increased essential oil percentage by 7.8% in the first season and 9.3% in the second one, over the control plants. These results proved to be true in the two seasons as clearly shown in Table (8). In accordance with these results, concerning amino acids were those of **Talaat and Youssef (2002)** reported that chemical constituents of basil plants were improved due to the application of tryptophan.

Table (8):Effect of amino acids and ascoppin treatments on volatile oil % of coriander plant plant during the 2011and 2012.

Amino acids treatment (strong amino gold)	Ascoppin treatments				
	Control	150g/100 l.	200 g/100 l.	250 /100 l.	Mean(A)
	First season				
Control	0.409	0.435	0.452	0.471	**0.449**
100 g/100 l.	0.426	0.448	0.475	0.490	**0.467**
150 g/100 l.	0.442	0.460	0.495	0.511	**0.484**
200 g/100 l.	0.449	0.470	0.481	0.514	**0.486**
Mean(B)	**0.432**	**0.453**	**0.476**	**0.497**	
LSD 5%	**A: 0.023**	**B:0.024**	**AB:0.045**		
	Second season				
Control	0.430	0.453	0.458	0.474	**0.454**
100 g/100 l.	0.447	0.473	0.480	0.499	**0.475**
150 g/100 l.	0.468	0.475	0.522	0.512	**0.496**
200 g/100 l.	0.468	0.479	0.513	0.512	**0.493**
Mean(B)	**0.453**	**0.472**	**0.493**	**0.499**	
LSD 5%	**A: 0.024**	**B:0.024**	**AB:0.046**		

Attoa *et al*., (2002) reported that spraying *Iberis amara* L. with tryptophan at 75 ppm. increased essential oil percent., **Talaat (2005)** on *Pelargonium graveolens* plants mentioned that tryptophan treatment enhanced chemical constituents, **Talaat**

and Aziz (2005) reported that essential oil percentage and total oil yield (ml /plant) were significantly increased as a result of foliar spray of chamomile plants with glutathione and nicotinic acid and **Nahed and Balbaa (2007)** on *Salvia farinacea* found that application of 100 ppm. tyrosine acid increased essential oil in leaves.

Antioxidant treatments, at the rates of 200 and 250g/100 l. significantly increased essential oil percentage in the two seasons as compared to untreated control. (Table 8). Meanwhile, the highest treatments antioxidants gave the highest values in both seasons. The treatment of (200g/100 l.) increased essential oil % over that of control treatment by 10.2 and 8.83 % in the first and second seasons, respectively, **Youssef *et al*., (2005)** pointed out that spraying *Matricaria chamomilla* plants with ascorbic acid at 100 to 200 mg/ l significantly increased essential oil percentage., **Noor- Eldeen (2005)** investigated the response of essential oil measurements of *Majorana hortensis* to ascorbic acid and citric acid foliar spray at 50 or 75 ppm. The investigator found that treatment 75 ppm. promoted essential oil % and **Hendawy and Ezz- Eldin (2010)** showed that foliar spray of ascorbic acid at 25 mg/l increased essential oil % of fennel plants.

The interaction between the two involved factors was significant in the two seasons. The maximum essential oil % was obtained by the use of amino acids (200g) in combination with ascoppin(ascorbic acid and citric acid) at 250g/100 l. in the first season and amino acids 150 combined with ascoppin at 200g/100 l. in the second on treatments as shown in Table (8).

Volatile oil yield per plant and per feddan:

Essential oil yield per plant were significantly increased due to supplying coriander plants with strong amino gold in the two seasons, in comparison with untreated plants. It was found that gradually increase due to the increase in strong amino gold rate, as the high rates (200g/100 l.) in the two seasons, toward, essential oil yield/fed. The highest two concentrations gave producing higher quantities of essential oil in both seasons with no significant differences being obtained in the two seasons between them as clearly shown in Tables (9&10). The increase in essential oil yield per fed.

Table(9):Effect of amino acids and ascoppin treatments on volatile oil yield (ml/plant) of coriander plant during the 2011and 2012.

Amino acids treatment (strong amino gold)	Ascoppin treatments				
	Control	**150 g/100 l.**	**200 g/100 l.**	**250 g/100 l.**	**Mean(A)**
	First season				
Control	0.079	0.092	0.099	0.101	**0.093**
100 g/100 l.	0.093	0.102	0.120	0.120	**0.109**
150 g/100 l.	0.108	0.111	0.138	0.133	**0.123**
200 g/100 l.	0.113	0.119	0.139	0.142	**0.128**
Mean(B)	**0.098**	**0.106**	**0.124**	**0.124**	
LSD 5%	**A: 0.007**	**B:0.005**	**AB:0.011**		
	Second season				
Control	0.087	0.099	0.106	0.107	**0.100**
100 g/100 l.	0.099	0.101	0.116	0.122	**0.110**
150 g/100 l.	0.116	0.120	0.140	0.138	**0.129**
200 g/100 l.	0.117	0.122	0.143	0.140	**0.131**
Mean(B)	**0.105**	**0.111**	**0.126**	**0.127**	
LSD 5%	**A: 0.009**	**B:0.006**	**AB:0.013**		

Table(10):Effect of amino acids and ascoppin treatments on volatile oil yield (l/fed.) of coriander plant during the 2011and 2012.

Amino acids treatment (strong amino gold)	Ascoppin treatments				
	Control	**150 g/100 l.**	**200 g/100 l.**	**250 g/100 l.**	**Mean(A)**
	First season				
Control	3.51	4.09	4.40	4.49	**4.12**
100 g/100 l.	4.13	4.53	5.33	5.33	**4.83**
150 g/100 l.	4.80	4.93	6.13	5.91	**5.44**
200 g/100 l.	5.02	5.28	6.18	6.31	**5.70**
Mean(B)	**4.37**	**4.71**	**5.51**	**5.51**	
LSD 5%	**A: 0.28**	**B: 0.25**	**AB: 0.51**		
	Second season				
Control	3.87	4.40	4.71	4.76	**4.44**
100 g/100 l.	4.40	4.49	5.16	5.42	**4.87**
150 g/100 l.	5.16	5.33	6.22	6.13	**5.71**
200 g/100 l.	5.20	5.42	6.36	6.22	**5.80**
Mean(B)	**4.66**	**4.91**	**5.61**	**5.63**	
LSD 5%	**A: 0.29**	**B: 0.25**	**AB: 0.53**		

due to the medium (150g/100 l.)concentration level recorded 32.0% in the first season and 28.6% in the second season , respectively, over control plants. The role of amino acids in increasing the yield of essential oil was reported by **Talaat (2005)** on *Pelargonium graveolens* plants mentioned that tryptophan treatment enhanced chemical constituents and **Nahed and Balbaa (2007)** on *Salvia farinacea* found that application of 100ppm. tyrosine acid increased essential oil/fed. in leaves. In regard with antioxidants(ascoppin), the three treatments resulted in highly significant increase in essential oil yield per plant in comparison with those of control plants in the two seasons.

Among the four treatments, the highest treatment surpassed significantly the other three single ones, while essential oil yield/fed. were obtained due to the two ascoppin rates 200 and 250g/100l. with no significant differences between them in the two seasons. The increase in the yield/fed. due to that triple treatment, in comparison with control one, reached 26.1 and 20.4 % in the first and second season, respectively. The role of antioxidants on increasing essential oil was insured by **Youssef *et al*., (2005)** pointed out that spraying *Matricaria chamomilla* plants with ascorbic acid at 100 to 200 mg/l. significantly increased essential oil percentage and **Ahmed (2005)** observed that essential oil % of marjoram plants was increased with all treatments of both citric acid and ascorbic acid compared to control treatments. While, the essential oil yield/fed. was increased with ascorbic acid at 75 ppm.

The interaction between amino acids and antioxidants was significant in both seasons. The highest essential oil yield per plant and per fed was obtained due the use of amino acids (200g) in combination with triple antioxidant (200or 250g/100 l.) in the first and second seasons, respectively, treatment as clearly shown in Tables (9&10) .

Nitrogen, phosphorus and potassium percentage:

Data obtained in Tables (11,12and13) indicated the existence of significant differences in herb nitrogen, phosphorus and potassium % due to the use of amino acids in comparison with those of control plants in the two seasons., shows the effect of the highest concentration of strong amino gold compound on the percentage of N,P and K significantly improved in relative to other concentrations. This trend was observed in the two experimental seasons. The mentioned results were in harmony with those obtained by the capability of amino acids in promoting herb N, P and K % was reported by **Hassanein (2003)**on *Foeniculum vulgarre* L. reported that plants applied with foliar amino acids caused an increase in N,P and K content and **Abd El-Aziz *et al*.(2010)** investigated the response of *Thuja orientalis* plants to foliar application of tyrosine, thiamine and tryptophan each at 25,50 and 100 ppm. found that increase in N,P and K percentage at 100ppm.

Concerning antioxidant treatments, the four examined concentrations resulted in significant rise, in the two seasons, in N, P and K herb % over those of control plants as given in Tables (11, 12 & 13). Foliar application of ascoppin at 200 g/l. was the best treatment, followed by ascoppin at 100 g/l. on coriander plants. Significantly increase in nitrogen, phosphorus and potassium percentage in both seasons was noted. Our results are harmony with those obtained by **Badran *et al*., (2013)** revealed that herb nitrogen, phosphorus and potassium content in the leaves of coriander plants were greatly promoted due to the application of ascorbic acid each at 200 or 300 ppm. and gave better results with the highest concentration for each antioxidant being more effective than the low one., **Al- Shareif (2006)** recorded that ascorbic acid at 200 ppm. increased the percentage of N and P in the fresh and dry leaves of caraway plants. and **Kenawy (2010)** found that supplying *Ammi visnaga* plants with ascorbic acid at 200 ppm. caused an increase in N, P and K % in the dry leaves.

Table (11): Effect of amino acids and ascoppin treatments on herb nitrogen % of coriander plant during the 2011and 2012.

Amino acids treatment (strong amino gold)	Ascoppin treatments				
	ontrol	150 g/100 l.	200 g/100 l.	250 g/100 l.	Mean(A)
	First season				
Control	1.79	1.80	1.89	1.95	**1.86**
100 g/100 l.	1.82	2.02	2.14	2.22	**2.05**
150 g/100 l.	1.88	2.18	2.35	2.41	**2.21**
200 g/100 l.	1.93	2.33	2.35	2.44	**2.26**
Mean(B)	**1.85**	**2.08**	**2.18**	**2.25**	
LSD 5%	**A: .05**		**B: .05**	**AB: .09**	
	Second season				
Control	1.82	1.99	1.99	2.02	**1.96**
100 g/100 l.	1.93	2.06	2.17	2.28	**2.11**
150 g/100 l.	1.98	2.15	2.39	2.39	**2.23**
200 g/100 l.	2.05	2.34	2.37	2.44	**2.30**
Mean(B)	**1.94**	**2.13**	**2.23**	**2.28**	
LSD 5%	**A: .06**		**B:.04**	**AB:.09**	

Table (12): *Effect* of amino acids and ascoppin treatments on herb phosphorus %of coriander plant during the 2011and 2012.

Amino acids treatment (strong amino gold)	Ascoppin treatments				
	Control	150 g/100 l.	200 g/100 l.	250 g/100 l.	Mean (A)
	First season				
Control	.424	.435	.436	.455	**.438**
100 g/100 l.	.433	.442	.465	.469	**.452**
150 g/100 l.	.438	.451	.473	.473	**.459**
200 g/100 l.	.445	.457	.486	.486	**.469**
Mean(B)	**.435**	**.446**	**.465**	**.471**	
LSD 5%	**A: .007 B:.009 AB:.015**				
	Second season				
Control	.441	.452	.470	.485	**.462**
100 g/100 l.	.460	.471	.499	.499	**.482**
150 g/100 l.	.472	.484	.510	.512	**.495**
200 g/100 l.	.485	.501	.524	.524	**.509**
Mean(B)	**.465**	**.477**	**.500**	**.505**	
LSD 5%	**A: .009 B:.012 AB:.020**				

Table (13): Effect of amino acids and ascoppin treatments on herb potassium% of coriander plant during the 2011and 2012.

Amino acids treatment (strong amino gold)	Ascoppin treatments				
	Control	150 g/100 l.	200 g/100 l.	250 g/100 l.	Mean(A)
	First season				
Control	2.33	2.42	2.50	2.58	**2.46**
100 g/100 l.	2.50	2.66	2.73	2.73	**2.66**
150 g/100 l.	2.67	2.80	2.91	2.99	**2.84**
200 g/100 l.	2.75	2.99	3.11	3.11	**2.99**
Mean(B)	**2.56**	**2.72**	**2.81**	**2.85**	
LSD 5%	**A: 0.15 B:0.17 AB:0.20**				
	Second season				
Control	2.41	2.48	2.56	2.62	**2.52**
100 g/100 l.	2.59	2.64	2.73	2.81	**2.69**
150 g/100 l.	2.73	2.85	2.92	3.07	**2.89**
200 g/100 l.	2.90	3.05	3.10	3.13	**3.05**
Mean(B)	**2.66**	**2.75**	**2.82**	**2.90**	
LSD 5%	**A: 0.16 B:0.19 AB:0.23**				

The interaction between strong amino gold compound and antioxidant (asscoppin) was significant in the two seasons for N, P and K % as shown in Tables (11, 12 and 13).

Chemical composition of essential oil:

a- Chemical composition of essential oil (control)

Essential oil of coriander fruits was extracted by steam distillation, fractionated and identified by GC/MS technique. The obtained data are Tabulated in Table (14) and illustrated in Fig.(1). From these results, it could be indicated that there are 41 components were isolated from coriander fruits essential oil. Twenty nine components were identified and classified into tenth chemical categories namely; aliphatic trepenes (0.63%), monocyclic terpenes (7.19%), bicyclic terpenes (11.75%), aliphatic terpene alcohols (62.05%), cyclic terpene alcohols (0.55%), cyclic terpene ketones (5.36%),

terpene esters (8.25%), terpene aldehydes (0.53%), aromatic hydrocarbons (1.23%), and aromatic alcohols (0.09%). These identified compounds accounted for 97.63% of the composition of coriander fruits essential oil. The remaining portion 2.37 % representing 12 unknown constituents.

The first chemical group in coriander fruits essential oil was aliphatic terpenes which consisted of one compound namely; β-myrcene (0.63%). This compound was reported as a constituent of coriander essential oil by **Misharina (2001)** who found that the amount of that compound was 0.80 % and **Ravi *et al*.,(2006)** reported that β-myrcene as a component of coriander essential oil.

The second recorded chemical group was monocyclic terpenes which consisted of seven compounds namely; α-thujene (0.08%), sabinene (0.23%), α-phellandrene (0.32%), α-terpinene (0.07%), dl-limonene (1.39%), γ-terpinene (4.31%) and α-terpinolene (0.79%). These compounds were reported as constituents of coriander essential oil according to **Misharina (2001**).

The third identified chemical group was bicyclic terpenes which consisted of three compounds namely; α-pinene (5.23 %), camphene (2.85 %) and β-pinene (3.67 %). These results are agreed with **Gil *et al*.,(2002)** and **Ravi *et al*.,(2007).** The fourth chemical group was aliphatic terpene alcohols which consisted of four compounds namely; cis linalool oxide (0.33 %), linalool (60.12 %), trans-geraniol (0.24 %) and nerol (1.36 %)

Table (14) Chemical composition of coriander fruits essential oil from control plants.

Compounds	**Retention time**	**Peak number**	**%**
Aliphatic terpenes			
β-Myrcene	0.7253	**6**	0.63
Total			**0.63**
Monocyclic terpenes			
α-Thujene	0.5945	1	0.08
Sabinene	0.6869	4	0.23
α-Phellandrene	0.7610	7	0.32
α-Terpinene	0.7791	8	0.07
d-Limonene	0.8091	10	1.39
γ-Terpinene	0.8705	11	4.31
α-Terpinolene	0.9168	13	0.79
Total			**7.19**
Bicyclic alcohols			
α-Pinene	0.6151	2	5.23
Camphene	0.6427	3	2.85
β-Pinene	0.7003	5	3.67
Total			**11.75**
Aliphatic alcohols			
Cis linalool oxide	0.8905	12	0.33
Linalool	* 1	14	60.12
Trans-Geraniol	1.1940	21	0.24
Nerol	1.2365	22	1.36
Total			**62.05**
Cyclic terpene alcohols			
Borneol	1.0982	16	0.18
4-Terpineol	1.1101	17	0.37
Total			**0.55**
Cyclic terpene ketone			
Camphor	1.0601	15	5.36
Total			**5.36**
Terpene esters			
Linalyl Propionate	1.1395	19	1.53
Myrtenyl Acetate	1.3504	27	0.23
Citronellyl Acetate	1.3917	28	0.07
Neryl Acetate	1.4080	29	0.09
Geranyl Acetate	1.4481	31	6.33
Total			**8.25**
Terpene aldehydes			
Decanal	1.1508	20	0.22
2-Decenal	1.2503	23	0.18
Un decanal	1.3254	26	0.08
2-Undecenal	1.4224	30	0.05
Total			**0.53**
Aromatic hydrocarbons			
ρ-Cymene-8-ol	1.1252	18	0.09
Total			**0.09**
Total known	24,25,32,33,34,35,36 37,38,38,39,40		**97.63**
Total unknown			**2.37**
Total oxygenated **compound**			**72.83**

*The retention time of Linalool (15.98) was taken as standard relative retention time equal one.

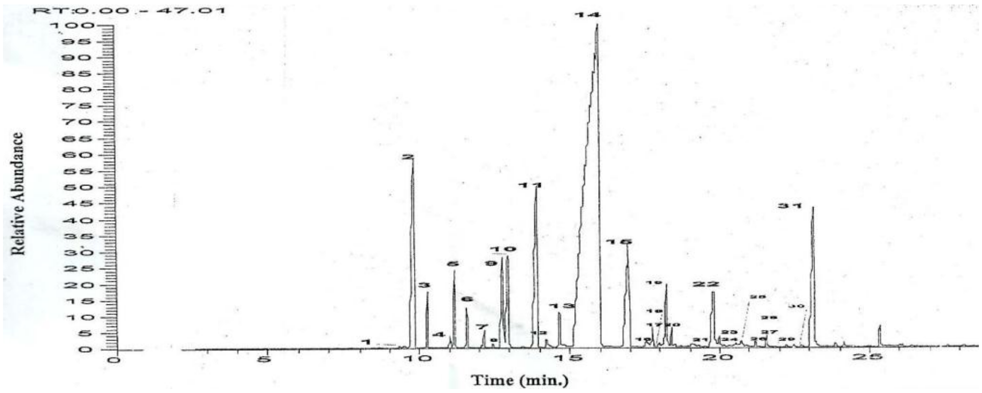

Fig. (1) Chemical components of coriander fruits essential oil obtained from control plants

Misharina (2001)reported that coriander essential oil has much higher amount of linalool as the predominant component arrived to about 69.75 %.

The fifth chemical group recorded and identified in coriander essential oil was cyclic terpene alcohols which consisted of two compounds namely; borneol (0.18 %), 4-terpineol (0.37%). All previous fifth groups identical with the compounds that Misharina (2001) have been identified.

The sixth chemical group fractioned and identified was cyclic terpene ketones which consisted of one compound namely camphor (5.36%). This compound was reported as constituent of coriander essential oil by **Gil *et al* ., (2002)**.

The seventh chemical group was terpene esters which consisted of five compounds namely., linalyl propionate (1.53%) , myrtenyl acetate (0.23%) citronellyl acetate (0.07%), neryl acetate (0.09%) and geranyl acetate (6.33%) .

The eighth identified group was terpenes aldehydes which consisted of four compounds namely., decanal (0.22%), 2-decanal (0.18%), undecanal (0.08%) and 2-undecanal (0.05%)

The ninth identified chemical group in coriander fruit essential oil, was aromatic hydrocarbons which consisted of a unique compound namely ., ρ-cymene (1.23%) .

Finally, the tenth identified chemical group was aromatic alcohols which consisted of one compound namely., ρ-cymene-8-ol (0.09%). The above mentioned results agreed with those of **Msaada *et al*., (2007)** who identified α-pinene, β-pinene, ρ-cymene, linalool and aldehydes as the main components of coriander essential oil.

B. Chemical composition of essential oil for treatment

The essential oil obtained from coriander fruits treated with amino acid (strong amino gold) compound at 200g/100 l. with ascoppin at 200g/100 l. in comparison with the chemical composition of coriander fruits essential oil (control), the fourth chemical group was aliphatic terpene alcohols which consisted of linalool and the tenth identified chemical group was aromatic alcohols which consisted of one compound namely; ρ-cymene-8-ol increase chemical composition in essential oil in

comparison with those of control plants. The obtained data were tabulated in Table (15) and illustrated in Fig.(2) from these results, it could be indicated that 40 components were isolated from this one treatment coriander essential oil. The identified compounds (28 compounds) accounted for 98.10% of the composition of this treatment. The remaining portion 1.90% representing 12 unknown constituents.

Table (15) Chemical composition of coriander fruits essential oil from treatment (Ami.150* Asc.200 g/100 l):

Compounds	Retention time	Peak number	%
Aliphatic terpenes:			
β-Myrcene	0.7451	6	0.69
Total			**0.69**
Monocyclic terpenes			
α-Thujene	0.6033	1	0.02
Sabinene	0.6971	4	0.23
α-Phellandrene	0.7710	7	0.32
α-Terpinene	0.7791	8	0.07
d-Limonene	0.8451	10	3.33
γ-Terpinene	0.9283	12	7.61
α-Terpinolene	0.9368	13	0.69
Total			**12.27**
Bicyclic alcohols:			
α-Pinene	0.6151	2	4.19
Camphene	0.6427	3	0.95
β-Pinene	0.7113	5	2.35
Total			**7.49**
Aliphatic alcohols:			
Cis linalool oxide	0.9103	11	0.22
Linalool	* 1	14	64.21
Trans-Geraniol	1.5560	20	0.24
Nerol	1.5763	22	0.28
Total			**64.95**
Cyclicterpene alcohols			
Borneol	1.3890	17	0.06
4-Terpineol	1.3915	18	0.13
Total			**0.19**
Cyclic terpene ketone			
Camphor	1.2633	16	2.75
Total			**2.75**
Terpene esters			
Linalyl Propionate	.1159	15	0.02
Myrtenyl Acetate	1.5930	23	0.14
Citronellyl Acetate	1.6771	27	3.07
Neryl Acetate	1.6922	28	0.05
Geranyl Acetate	1.7321	29	2.68
Total			**5.96**
Terpene esters			
Linalyl Propionate	.1159	15	0.02
Myrtenyl Acetate	1.5930	23	0.14
Citronellyl Acetate	1.6771	27	3.07
Neryl Acetate	1.6922	28	0.05
Geranyl Acetate	1.7321	29	2.68
Total			**5.96**
Terpene aldehydes			
Decanal	1.1508	21	0.23
2-Decenal	1.6153	24	0.15
Undecanal	1.6255	25	0.10
2-Undecenal	1.6424	26	0.03
Total			**0.51**
Aromatic hydrocarbons			
ρ-Cymene	0.7893	9	3.17
Total			**3.17**
Aromatic alcohols			
ρ-Cymene-8-ol	1.4273	19	0.12
Total			**0.12**
Total known	30,31,32,33,34,35,36 37,38,38,39,40		**98.10**
Total unknown			**1.90**
Total oxygenated compound			**73.50**
Total no oxygenated compound			**24.60**

compounds namely; α-thujene (0.02%), sabinene (0.23%),
α-phellandrene (0.32 %),
α-terpinene (0.07 %), dl-limonene (3.33 %),
γ-terpinene (7.61 %) and
α-terpinolene (0.69 %).

These compounds were reported as constituents of coriander essential oil according to **Misharina (2001**).

The third identified chemical group was bicyclic terpenes which consisted of three compounds namely; α-pinene (4.19 %), camphene (0.95%) and β-pinene (2.35 %). These results are agreed with **Gil *et al*.,(2002)** and **Ravi *et al*.,(2007).**

The fourth chemical group was aliphatic terpene alcohols which consisted of four compounds namely; cis linalool oxide (0.22%), linalool (64.21 %), trans-geraniol (0.24%) and nerol (0.28%) **Misharina (2001**) reported that coriander essential oil has much higher amount of linalool as the predominant component arrived to about 69.75 %.

The fifth chemical group recorded and identified in coriander essential oil was cyclic terpene alcohols which consisted of two compounds namely; borneol (0.06 %), 4-terpineol (0.13 %). All previous fifth groups identical with the compounds that Misharina (2001) have been identified.

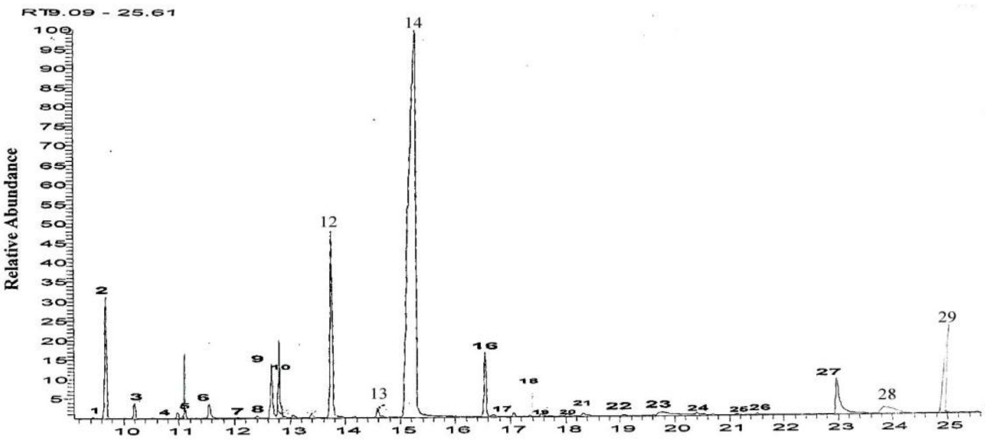

Fig. (2) Chemical components of coriander fruits essential oil treated with (strong amino gold at 200g combined with ascoppin at 200g/100l.)

The first chemical group in coriander fruits essential oil was aliphatic terpenes which consisted of one compound namely; β-myrcene (0.69%). This compound was reported as a constituent of coriander essential oil by **Misharina (2001)** who found that the amount of that compound was 0.80 % and **Ravi *et al*.,(2007)** reported that β-myrcene as a component of coriander essential oil.

The second recorded chemical group was monocyclic terpenes which consisted of seven.

The sixth chemical group fractioned and identified was cyclic terpene ketones which consisted of one compound namely camphor (2.75%). This compound was reported as constituent of coriander essential oil by **Gil *et al* ., (2002)**.

The seventh chemical group was terpene esters which consisted of five compounds namel., linalyl propionate (0.02%) , myrtenyl acetate (0.14%) citronellyl acetate (3.07%), neryl acetate (0.05%) and geranyl acetate (2.68%) .

The eighth identified group was terpenes aldehydes which consisted of four compounds namely., decanal (0.23%), 2-decanal (0.15%), undecanal (0.10%) and 2-undecanal (0.03%).

The ninth identified chemical group in coriander fruit essential oil, was aromatic hydrocarbons which consisted of a unique compound namely ., ρ-cymene (3.17%) .

Finally, the tenth identified chemical group was aromatic alcohols which consisted of one compound namely., ρ-cymene-8-ol (0.12%). The above mentioned results agreed with those of **Msaada *et al*., (2007)** who identified α-pinene, β-pinene, ρ-cymene, linalool and aldehydes as the main components of coriander essential oil.

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التأثيرات الفسيولوجية للأحماض الأمينية والأسكوبين علي النمو والمحصول والتركيب الكيميائي لنبات الكزبرة

ياسر على محمد حافظ

أجريت هذه الدراسة بمحطة بحوث البساتين بسدس– معهد بحوث البساتين – مركز البحوث الزراعية خلال موسمي الزراعة ٢٠١٢/٢٠١١، ٢٠١٣/٢٠١٢ م وقد اشتملت تلك الدراسة على دراسة مدى استجابة النمو الخضري والمحصول والنسبة المئوية ومكونات الزيت الطيار لنبات الكزبرة تحت ظروف منطقة مصر الوسطي للأحماض الأمينية (مركب أسترونج أمينو جولد) ومركب الأسكوبين وذلك كالأتي أربع تركيزات مختلفة من مركب أسترونج أمينو جولد (صفر، ١٠٠، ١٥٠، ٢٠٠ جم/١٠٠ لتر ماء) مع مركب الأسكوبين بتركيزات مختلفة (صفر ، ١٥٠ ، ٢٠٠ ، ٢٥٠جم/١٠٠ لتر ماء) مع تسميد الكزبرة بنصف الكمية الموصي بها من السماد المعدني مع كل من معاملات التسميد الورقي (سواء مركب أسترونج أمينو جولد أو مركب الأسكوبين) إلى تحسن معنوي حيث كان هناك تأثيرا ايجابيا في صفات النمو الخضري المختلفة كارتفاع النبات وسمك الساق ووزن العشب الجاف/نبات وكانت أفضل المعاملات لهذه الصفات هي الناتجة من المعاملة (٢٠٠ جم من مركب أسترونج أمينو جولد مع ١٥٠ جم من مركب الأسكوبين) سواء في حالة منفردة أو في حالة تداخل مقارنة بالمعاملة القياسية وكان هناك تحسن واضح ومعنوي في خصائص المحصول لنبات الكزبرة وهي عدد الثمار للنبات وكمية محصول البذرة للنبات والفدان وكذلك النسبة المئوية ومكونات الزيت باستخدام تركيز ٢٠٠ جم من مركب ستر ونج أمينو جولد مع١٥٠ الي ٢٠٠ جم من مركب الأسكوبين حيث أعطت أفضل النتائج وكان التفاعل المشترك بين عاملي التجربة معنويا علي صفات النمو الخضري ومكونات المحصول والخصائص الكيميائية لذا يوصي من وجهة النظر الاقتصادية تحت ظروف التجربة بمعاملة نبات الكزبرة بمركب أستر ونج أمينو جولد بتركيز ٢٠٠ جم مع مركب الأسكوبين بتركيز ٢٠٠ جم/١٠٠ لتر ماء وذلك برش النبات ثلاث مرات تبدأ بعد الزراعة بشهر ونصف وعلي فترات كل ثلاثة أسابيع وذلك لتحسين النمو الخضري ومكونات المحصول والنسبة المئوية ومكونات الزيت الطيار.