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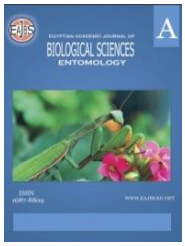

Effect of Treated Squash Plants by Cytokinin Hormone (CKs) on the Infestation by *Bemisia tabaci* and *Tetranychus urticae*

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ABSTRACT

This study was carried out to study effect of treated squash plants *Cucurbita pepo* L. (var. Andro 174) by two concentrations of Cytokinin Hormone CKs (25 ppm and 45 ppm) on the infestation by *Bemisia tabaci* (Hemiptera: Aleyrodidae) and *Tetranychus urticae* Koch (Fam: Tetranychidae) at Giza Governorate during 2017, 2018 seasons under glasshouse conditions.

Results obtained showed that squash plants treated with a small concentration of CKs (25ppm) were lower infestation by both *B. tabaci* and *T. urticae* compared to control (plants which did not treat with any hormone). While squash plants treated with a high concentration of CKs (45ppm) were higher infestation by both the two pests compared to control.

Also, results obtained showed that treated squash plants with a small concentration of CKs improved morphological characteristics and internal components of these plants compared to control, while when treated squash plants with a high concentration of the same hormone had badly effect on the morphological characteristics and internal components of these plants compared to control.

INTRODUCTION

Squash (*Cucurbita pepo* L.) considers one of the most important vegetable crops in Egypt and all over the world which cultivated in the open field and under glasshouse conditions. Also, its cultivated area increased gradually during the last years, especially in the newly reclaimed areas for purposes local consumption and exportation to the foreign markets, Hanafy 2004.

Squash fruits contain some nutritional compounds for human feeding such as the moderate quantity of mineral salts, it is eaten cocked as an immature fruit which is rich with fibers and vitamins or consumed for the mature seed which is a good source of fats and protein (Abdein 2016). It has a high economic value, and a nutritive food source especially vitamins and is one of the most popular vegetables grown in Egypt (Shehata *et al*. 2009).

Squash crop infested with large scale of different insects such as *Bemisia tabaci* (Hemiptera: Aleyrodidae) which consider one of the most damaging insects infesting vegetables crops either in the open field or under greenhouse conditions (Adriaan *et al*. 2013) who reported that the *B. tabaci* seen as highly population on squash plants both in the open field and under greenhouse conditions. Also, *B. tabaci* besides its effects on leaves and fruits

transmit Cucumber Mosaic Virus (CMV), Deborah *et al.* (2012) who reported that *B. tabaci* transmit Cucumber Mosaic Virus (CMV) which causes a serious disease of narrow-leafed lupin. Also, aphids cause sporadic yield losses due to direct feeding damage, Marabi *et al* (2017) reported that *B. tabaci* is a harmful pest on most vegetable crops and causes direct damage by reducing plant vigor, and indirect damage by honeydew secretion and transmission of several viruses.

Red spider mite, *Tetranychus urticae* Koch (Fam: Tetranychidae) also consider one of the most important pests infesting squash plants both in the open field and under glasshouse conditions. *T. urticae* is a species of plant-feeding mite generally considered to be a serious pest on cucumber plants and other vegetable crops. It is the most widely known member of the family Tetranychidae or spider mites and called red spider mite. Derek (2013) reported that *T. urticae* was a serious pest on squash plants under glasshouse conditions. Also, this crop was infested by two-spotted spider mite and whitefly (El-Dars *et al*., 2013). The last pests cause numerous damage in both quantity and quality for crop directly by plant juice loosen or indirectly by plant disease transmitting (Abdel-Salam *et al*. 1982). Also, more than 200 host plant species were infested by these pests (Abdallah *et al*., 2014). A number of vegetable crops such as tomato, squash, eggplant, cucumber was also subject to *Tetranychus urticae* Koch (Acari: Tetranychidae) infestations during summer plantation causing numerous injuries and yield losses (Kherebe *et al.* 2015). The whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) caused crop losses by transmitting up to 150 virus species and by inducing plant disorders as likely as squash silver leaf (Polston *et al.* 2014). Moreover, whitefly secreted honeydew on leaf surface, which lead to the growth of sooty mold fungi, then reduced the efficiency of leaves during photosynthesis processes (Burger *et al.* 2014).

Cytokinin Hormone (CKs) considers one of the most famous and important phytohormon. There are more studies that show the important role of this hormone for growth regulators plants. And its role for change morphological and physiological plant adjectives when used by different concentrations. Marcel (2015) reported that Cytokinins are plant hormones that have among many other functions on the morphological and physiological characteristics on different plants. Giron *et al.* (2013) who reported that phytohormone Cytokinins play important roles in regulating plant growth and defence against many dangerous pests. Srivastava and Srikant (2015) in India studied effect of Cytokinin Hormone on photosynthesis, alkaloid, and other parameters in *Papaver somniferum* L. and studied the influence of different foliar application of Cytokinin hormone on growth, co2, exchange rate, total chlorophyll, plant height and weight and fresh and dry weight of the leaves and shoots.

So, this study was carried out to study the effect of treated squash plants by two concentrations of Cytokinin Hormone (CKs) on the infestation by *B. tabaci* and *T. urticae* at Giza during throughout the two successive seasons, 2017 and 2018.. Also, this study was carried out to study the effect of treated squash plants by the same concentrations of the same hormone on the morphological characteristics and internal components of treated squash plants.

MATERIALS AND METHODS

Experimental Design:

This study was conducted on squash plants *Cucurbita pepo* L. var. Andro 174 at Giza Governorate during 2017, 2018 seasons. The squash seeds were planted on 15th March throughout both the two seasons (timely manner for the cultivation of squash) at the Perkash region, Giza Governorate. At both the two seasons we used two glasshouses, each glasshouse divided into three parts, two parts for the two treatments (two concentrations of CKs) and the

third part left as a control. In the first treatment we immersion squash seeds in low concentration of CKs (25ppm) for period 24 hour before cultivated, in the second treatment we immersion seeds in high concentration of CKs (45ppm) for period 24 hours, and in the third treatment we did not immersion squash seeds in any hormone before cultivated, this treatment used as control. These seeds cultivated under glasshouse conditions at both the two seasons at the same time. Then it was conducted all agricultural operations in a manner quite similar at the two locations. The normal and recommended agricultural practices were applied, also no chemical control against insects were used during the whole experimental period.

An artificial infestation with *B.tabaci* was done at the first glasshouse and artificial infestation with *T. urticae* was done at the second glasshouse at the same time in both the two seasons. It is proven accurate observations of the infestation by the two pests number in all plants biweekly. Directly counting was done biweekly during the seasons at both the two seasons all over five plants from each replect.

Laboratory Design:

Laboratory studies were carried out to study effect of treated squash plants by different concentrations of Cytokinin Hormone (CKs) on the morphological characteristics of treated squash plants such as root length (cm), shoot length (cm) and plant height (cm) and comparing these characteristics with control plants which did not treat with any hormone.

Also, these laboratory experiments were carried out to study effect of treated squash plants by the same concentrations of Cytokinin Hormone (CKs) on the internal components of treated squash plants such as total protein (mg/g), total sugar (mg/g), starch (mg/g), amino acids (mg/g) and total phenols (mg/g), and comparing these concentrations with control plants which did not treat with any hormone.

Statistical Analysis:

In these experiments, the effect of treated squash plants by different concentrations of (CKs) on the infestation by *B.tabaci* and *T. urticae*. And the effect of treated squash plants by different concentrations of (CKs) on the morphological characteristics and the internal components of squash plants were subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 level, using SAS program (SAS Institute, 1988).

RESULTS AND DISCUSSION

This study was carried out to study effect of treated squash plants *Cucurbita pepo* L. var. Andro 174 by two concentrations of Cytokinin Hormone CKs (25 ppm and 45ppm) of the infestation by *Bemisia tabaci* (Hemiptera: Aleyrodidae) and *Tetranychus urticae* Koch (Fam: Tetranychidae) at Giza Governorate during 2017, 2018 seasons under glasshouse conditions

Season 2017:

Data tabulated in Table (1) show the population fluctuation of *B. tabaci* and *T. urticae* on squash plants treated by different concentrations of Citokinin Hormone (CKs) at Giza Governorate during 2017 season.

Data obtained showed that squash plants treated by low concentration of CKs (25ppm) were lower infestation by both *B. tabaci* and *T. urticae* compared to control and squash plants which treated by a high concentration of CKs were higher infestation by both the two pests compared to control. Whereas a mean number of *B. tabaci* in control was (35.7 nymph/leaf), mean number in the first treatment (low concentration of CKs) was (26.4 nymph/leaf), And mean number of *B. tabaci* in the second treatment (high concentration of CKs) was (40.6 nymph/leaf). Also, as the same trend, the mean number of *T. urtcae* in control was (23.3 pest/leaf), mean number in the first treatment was (13.6 pest/leaf), And the mean number in the second treatment was (28.8 pest/leaf).

Table (1): Population fluctuation of *B. tabaci* and *T. urticae* on squash plants which treated by different concentrations of Cytokinin Hormone (CKs) at Giza Governorate during 2017 season

Date	*B. tabaci*			*T. urticae*		
	25 ppm	45 ppm	control	25 ppm	45 ppm	control
1/4/2017	19.8 c	29.3 b	26.4 a	6.3 b	20.3 b	16.2 a
8/4/2017	21.4 c	33.4 c	29.5 a	8.4 c	21.7 b	17.4 a
15/4/2017	23.5 b	36.5 c	31.2 a	10.8 c	25.3 b	19.5 a
22/4/2017	25.9 c	38.7 b	33.8 a	12.3 b	27.5 c	21.3 a
29/4/2017	26.5 c	39.8 b	36.5 a	13.2 c	29.1 c	22.5 a
6/5/2017	27.4 b	44.7 c	38.3 a	15.8 b	31.8 b	23.9 a
13/5/2017	29.3 c	45.6 b	40.4 a	17.2 c	33.2 c	27.7 a
20/5/2017	31.7 c	47.9 b	41.4 a	18.3 c	34.4 c	29.5 a
27/5/2017	32.5 c	49.3 c	43.5 a	20.5 c	35.5 b	31.3 a
Total	**238.0**	**356.2**	**321.0**	**122.8**	**258.8**	**209.3**
Mean	**26.4**	**40.6**	**35.7**	**13.6**	**28.8**	**23.3**
F(0.05)	**789.32**			**832.75**		
LSD	**1.022**			**1.034**		

Means within columns bearing different subscripts are significantly different (P< 0.05)

Season 2018:

Data tabulated in Table (2) show the population fluctuation of *B. tabaci* and *T. urticae* on squash plants treated by different concentrations of Citokinin Hormone (CKs) at Giza Governorate during 2018 season.

Data obtained showed that squash plants treated by low concentration of CKs (25ppm) were lower infestation by both *B. tabaci* and *T. urticae* compared to control, squash plants which treated by a high concentration of CKs (45ppm) were higher infestation by both the two pests compared to control. Whereas mean number of *B. tabaci* in control was (34.6 nymph/leaf), the mean number in the first treatment (low concentration of CKs) was (25.1 nymph /leaf), and the mean number of aphid in the second treatment (high concentration of CKs) was (40.3 nymph /leaf). Also, as the same trend, the mean number of *T. urticae* in the control was (22.4 pest/leaf), the mean number in the first treatment (low concentration of CKs) was (12.7 pest/leaf). And the mean number in the second treatment (high concentration of CKs) was (27.9 pest/leaf).

These results agree with those obtained by Heba (2013) in Egypt who reported that the plants (*Zea mays*) which treatment with a low concentration of Triacontanol Hormone TRIA (35 ppm.) was low infestation with *Euprepocnemis plorans* comparing to control. And the plants treated with high concentration of the same hormone (50 ppm.) were high infestation with the same insect comparing to control. Also, Giron *et al.* (2013) reported the role of CKs (Cytokinin Hormone) in pest control and reported that plants were treated with low concentration of (CKs) were less infestation by insects than control plants. Singh and Bhattacharya (2015) recorded an efficient role of CKs in reduction of survivorship and developmental parameters of larvae of *Spilarctia oblique* Walker upon feeding on diets containing CKs, referring to insecticidal activity of CKs. From the entire last, it was suggested the incorporation of CKs in the Integrated Pest Management (IPM) modules for pest control.

Table (2): Population fluctuation of *B. tabaci* and *T. urticae* on cucumber plants which treated by different concentrations of Cytokinin Hormone (CKs) at Giza Governorate during 2018 season

Date	*B. tabaci*			*T. urticae*		
	25 ppm	45 ppm	control	25 ppm	45 ppm	control
1/4/2017	18.5 c	28.5 b	25.5 a	5.5 b	19.5 b	15.5 a
8/4/2017	20.6 c	33.7 c	28.7 a	7.8 c	21.8 b	16.8 a
15/4/2017	22.5 b	35.5 c	30.5 a	9.7 c	23.5 b	18.3 a
22/4/2017	24.9 c	37.7 b	32.3 a	11.4 b	26.5 c	20.5 a
29/4/2017	25.3 c	39.5 b	35.2 a	12.2 c	28.6 c	21.8 a
6/5/2017	26.8 b	44.7 c	37.3 a	14.8 b	30.8 b	22.3 a
13/5/2017	27.3 c	46.7 b	39.4 a	16.2 c	32.2 c	26.7 a
20/5/2017	29.7 c	47.9 b	40.4 a	17.3 c	33.4 c	28.5 a
27/5/2017	30.3 c	48.3 c	42.5 a	19.5 c	34.5 b	31.3 a
Total	**225.9**	**362.5**	**311.8**	**114.4**	**250.8**	**201.7**
Mean	**25.1**	**40.3**	**34.6**	**12.7**	**27.9**	**22.4**
F(0.05)	**675.45**			**735.25**		
LSD	**1.035**			**1.025**		

Means within columns bearing different subscripts are significantly different (P< 0.05)

Effect of Cytokinin Hormone (CKs) on the Morphological Characteristics and Internal Components of Squash Plants:

Data tabulated in table (3) show the effect of treated squash plants by different concentrations of Cytokinin Hormone (CKs) on the morphological characteristics and internal components of these plants.

Table (3): Effect of treated squash plants by different concentrations of Cytokinin Hormone (CKs) on the morphological characteristics and internal components:

Adjective	25ppm	45ppm	Control
Root length (cm)	113.76 c	85.42 b	94.25 a
Shoot length (cm)	153.43 c	126.28 a	134.21 a
Plant height (cm)	267.19 c	211.70 b	228.46 a
Total protein (mg/g)	20.75 c	12.257 a	15.45 a
Total sugars (mg/g)	31.84 c	21.45 b	25.75 a
Strach (mg/g)	43.65 c	30.78 b	33.86 a
Amino acids (mg/g)	15.13 c	6.67 a	9.77 a
Total phenol (mg/g)	13.65 c	4.35 b	7.85 a

Obtained results showed that squash plants which treated with low concentration of CKs (25ppm) improved morphological characteristics of treated plants such as (root length, shoot length and plant height) and internal components of squash plants such as (total protein, total sugars, starch, amino acids, and total phenols) compared to control, and squash plants which treated with high concentration of CKs had badly effect of the morphological characteristics and internal components of these plants compared to control.

These results agreement with those obtained by Kumaravelu *et al.* (2016) in India who reported that the morphological characteristics such as (root length, shoot length, plant

height, and other morphological characteristics) and physiological characteristics such as (total protein, total sugars, starch, total phenol, and other physiological characteristics) were improved when we treated plants with small and medium concentrations of Cytokinin Hormone (CKs) and became better than control. And these characteristics were worse than control when we treated plants with high concentration of (CKs), Shukla *et al.* (2013) in Netherlands studied effect of Cytokinin Hormone (CKs) at lower concentrations on growth, plant hormones and artemisinin yield in *Artemisia annua* and found when treated plants with (CKs) produced a statistically significant positive effect on artemisinin level as well as on plant height, leaf and herbage yield, but theses adjectives decreased when treated plants with higher concentrations of (CKs). Also, these results agreements with those obtained by Eriksen *et al.* (2015) in Oslo (Nerweg) who reported that when treated tomato and maize plants with Cytokinin (CKs) caused a significant increase in the dry weight of the tomato plants, leaf area and dry weight measurements of tomato leaves at different stages of development. Richard and Stanley, (2005) in Michigan – United States reported that Cytokinin (CKs) increased fresh and dry weight and total reducible nitrogen (total N) of rice (*Oryza sativa* L.) seedlings.

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ARABIC SUMMARY

تأثير معاملة نباتات الكوسة بهرمون السيتوكينين (CKs) على درجة الإصابة ب *Bemisia tabaci* و *Tetranychus urticae* تحت ظروف الصوب الزجاجية

هيام مصطفى سعد
معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة – مصر

الهدف من إجراء الدراسة هو معرفة تأثير معاملة نباتات الكوسة *Cucurbita pepo* L. بهرمون السيتوكينين (CKs) بتركيزات مختلفة على درجة الإصابة بحشرة *Bemisia tabaci* و *Tetranychus urticae*. أجريت التجربة فى محافظة الجيزة خلال عامى 2017, 2018.

توصلت النتائج المتحصل عليها إلى وجود تأثير واضح وفروق معنوية واضحة لإصابة نباتات الكوسة المعاملة بتركيز منخفض من هرمون (CKs) (25 جزء فى المليون) على درجة الإصابة بكلا من حشرة الذبابة البيضاء *B.tabaci* و العنكبوت الأحمر *T. urticae* حيث قل متوسط تعداد كلتا الأفتين على النباتات المعاملة بالهرمون وذلك مقارنة بالنباتات الغير معاملة (الكنترول) . بينما عند معاملة نباتات الكوسة بتركيز مرتفع من ذات الهرمون (45 جزء فى المليون) كان له تأثير سلبى واضح على مستوى إصابة نباتات الكوسة بكلتا الافتين حيث تزايد متوسط تعداد كلاهما على النباتات المعاملة وذلك مقارنة بالنباتات الغير معاملة (الكنترول).

أيضا تم دراسة تأثير معاملة نباتات الكوسة بنفس التركيزات المختلفة من هرمون السيتوكينين على أهم الصفات المورفولوجية وكذلك المكونات الداخلية لنباتات الكوسة المعاملة. حيث إتضح من إجراء القياسات المورفولوجية لكلا من النباتات المعاملة بالهرمون وكذلك الكنترول أن إستخدام التركيز المنخفض من الهرمون أدى إلى تحسن الصفات المورفولوجية لنباتات الكوسة المعاملة مقارنة بالنباتات الغير معاملة (الكنترول) مثل طول المجموع الجذرى, طول المجموع الخضرى وأيضا الارتفاع الكلى للنبات.كما أدى أيضا إلى تحسن فى المحتويات الداخلية للنباتات المعاملة مثل مستوى البروتين الكلى, إجمالى السكريات , محتوى النشا , الأحماض الأمينية و أيضا إجمالى الفينولات وذلك مقارنة بالكنترول. بينما عند معاملة نباتات الكوسة بالتركيز المرتفع من الهرمون (45جزء فى المليون) أدى إلى إنخفاض مستوى كلا من الصفات المورفولوجية والمحتويات الداخلية للنباتات المعاملة وذلك بالمقارنة بالنباتات الغير معاملة (الكنترول) .

ونستخلص من هذه الدراسة أنه يمكن التوصية بإستخدام هرمون السيتوكينين ليس فقط كمحفز لنمو النباتات وتحسين صفاتها المورفولوجية ومحتوياتها الداخلية وإنما يمكن كذلك إدراجه فى برامج المكافحة المتكاملة للحشرات (I.P.M) وذلك بالجرعات الموصى بها فى هذه الدراسة.