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Role of Triacontanol Hormone (TRIA) on the Control of *Aphis gossypii* Glover on Cucumber Plants under Greenhouse Conditions

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ABSTRACT

This study was carried out to study effect of treated cucumber plants var. *Cucumis sativus* L. by different concentrations of Triacontanol Hormone (TRIA) on the infestation by *Aphis gossypii* Glover at two locations (governorates), Giza overnorate and Qaluobiya Governorate during 2018 season under glasshouse conditions. Also, this study was carried out to study effect of treated cucumber plants by the same concentrations of (TRIA) hormone on the morphological characteristics and internal components of treated cucumber plants. This study was carried out on three concentrations of Triacontanol Hormone, (25ppm), (35ppm) and (55ppm), beside fourth treatment which did not treat with any hormone (control). Results obtained showed that cucumber plants which treated with small concentration of (TRIA) (25ppm) were lower infestation by *A. gossypii* comparing to control. While cucumber plants which treated with medium concentration of (TRIA) (35ppm) were had no significant differences in the infestation by the same insect compared to control, on the other hand cucumber plants which treated by high concentration of (TRIA) (55ppm) were higher infestation by the aphid compared to control.

Keywords: Aphis gossypii - Triacontanol Hormone - cucumber - Glasshose conditions

INTRODUCTION

Cucumber fruits consider one of the most important vegetables crops in Egypt and all over the world which cultivated in the open field and under greenhouses conditions. Also, its cultivated area increased gradually during the last years, especially in the new reclaimed areas for purposes local consumption and exportation to the foreign markets, Hanafy 2004.

Cucumber crop infested with large scale of different insects belong to many different families and orders such as *Aphis gossypii* Glover (Homoptera : Aphididae) which consider one of the most damaging insects infesting cucumber plants and most vegetables crops either in the open field or under greenhouses conditions, (Adriaan *et al*. 2013) who reported that the aphid *A. gossypii* seen as highly population on cucumber crop both in the open field and under greenhouse conditions. Also, *A. gossypii* beside its effects on leaves and fruits transmit Cucumber Mosaic Virus (CMV), Deborah *et al.* (2012) who reported that *A. gossypii* 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. Wang et al. (2007) who reported that *A. gossypii* was a most harmful pest to the cucumber plants in greenhouse.

Triacontanol Hormone (TRIA) considers one of the most important growth regulators hormones. Which has play an important role for growth regulators plants through improving morphological and physiological plant characteristics when used by certain concentrations, Srivastava and Srikant (2015) in India studied effect of Triacontanol hormone on photosynthesis, alkaloid, and other parameters in *Papaver somniferum* L. and studied the influence of different foliar application of triacontanol hormone (TRIA) on growth, co2, exchange rate, total chlorophyll, plant height and weight and fresh and dry weight of the leaves and shoots. This study was carried out in glasshouse conditions.

This study was carried out to study effect of treated cucumber plants *Cucumis sativus* L. by different concentrations of Triacontanol Hormone (TRIA) on the infestation by *A. gossypii* at two locations (governorates), Giza Governorate and Qaluobiya Governorate during 2018 season under glasshouse conditions. Also, this study was carried out to study effect of treated cucumber plants by the same concentrations of the same hormone on the morphological characteristics and internal components of treated cucumber plants.

MATERIALS AND METHODS

Experimental design:

This study was conducted on cucumber plants var. *Cucumis sativus* L. at two locations (governorates), Giza Governorate and Qaliobya Governorate during 2018 season. Plants were cultivated at both the two locations at the same time in a timely manner for the cultivation of cucumber (late summer planting) during period (June – July). At both the two locations we planted cucumber plants at two glasshouses and we divided each glasshouse into four parts, three parts for the three treatments (three concentrations of TRIA) and the fourth part left as control.

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In the first treatment we immersion cucumber seedlings in low concentration of (TRIA) 25ppm for period 24 hour before cultivated. In the second treatment we immersion seedlings in medium concentration of (TRIA) 45ppm for period 24 hour before cultivated. In the third treatment we immersion seedlings in high concentration of (TRIA) 65ppm for period 24 hour before cultivated. Lastly, in the fourth treatment we did not immersion cucumber seedlings in any hormone before cultivation, this treatment used as control. These seedlings cultivated under glasshouse conditions at both the two locations 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 *A. gossypii* was done at the same time in the two locations. It is proven accurate observations of the infestation by the aphid number in all plants biweekly. Directly counting was done biweekly during the seasons at both the two locations all over all plants.

Laboratory design:

Laboratory studies was carried out to study effect of treated cucumber plants by different concentrations of Triacontanol Hormone (TRIA) on the morphological adjectives of treated cucumber plants such as root length (cm), shoot length (cm) and plant height (cm) and comparing these adjectives with control plants which did not treat with any hormone. Also, these laboratory experiments was carried out to study effect of treated cucumber plants by the same concentrations of Triacontanol Hormone (TRIA) on the internal components of treated cucumber 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, effect of treated cucumber plants by different concentrations of (TRIA) on the infestation by *A. gossypii*. Also, effect of treated cucumber plants by different concentrations of (TRIA) on the morphological characteristics and the internal components of cucumber 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 cucumber plants var. *Cucumis sativus* L. by different concentrations of Triacontanol Hormone (TRIA) on the infestation by *Aphis gossypii* Glover and *Bemisia tabaci* (Gennadius) at two locations (governorates), Giza overnorate and Qaluobiya Governorate during 2018 season under glasshouse conditions. Also, this study was carried out to study effect of treated cucumber plants by the same concentrations of the same hormone on the morphological adjectives and internal components of treated cucumber plants.

Efeect of treated cucumber plants by (TRIA) on the infestation by *A. gossypii*

Data tabulated in Table (1) show the population fluctuation of *A. gossypii* on cucumber plants which treated by different concentrations of TRIA at both Giza Governorate and Qaluobiya Governorate during 2018 season.

Table 1. Population fluctuation of *A. gossypii* on cucumber plants which treated by different concentrations of TRIA at Giza Governorate and Qaluobiya Governorate during 2018 season

Date	Giza Governorate				Qaluobiya Governorate			
	25ppm	35ppm	55ppm	Control	25ppm	35ppm	55ppm	Control
1/6/2018	6.7 ^{c}	22.5 ^{a}	25.6 ^{b}	23.3 ^{a}	2.3 ^{b}	12.7 ^{a}	16.3 ^{b}	13.3 ^{a}
8/6/2018	8.6 ^{c}	26.3 ^{a}	28.4 ^{b}	26.2 ^{a}	4.4 ^{c}	14.9 ^{a}	17.7 ^{b}	15.4 ^{a}
15/6/2018	10.2 ^{b}	27.7 ^{a}	31.1 ^{c}	28.7 ^{a}	6.8 ^{c}	16.2 ^{a}	19.3 ^{b}	17.8 ^{a}
22/6/2018	11.4 ^{c}	29.1 ^{a}	33.3 ^{b}	30.6 ^{a}	8.3 ^{b}	19.6 ^{a}	22.5 ^{c}	20.5 ^{a}
29/6/2018	13.7 ^{c}	33.8 ^{a}	37.2 ^{b}	33.8 ^{a}	10.2 ^{c}	21.8 ^{a}	25.1 ^{b}	22.7 ^{a}
6/7/2018	15.4 ^{b}	34.2 ^{a}	38.7 ^{c}	35.2 ^{a}	11.8 ^{b}	23.1 ^{a}	27.8 ^{b}	24.3 ^{a}
13/7/2018	17.1 ^{c}	35.3 ^{a}	40.3 ^{a}	36.4 ^{a}	12.2 ^{c}	23.7 ^{a}	29.2 ^{c}	24.7 ^{a}
20/7/2018	17.7 ^{c}	37.2 ^{a}	42.5 ^{b}	37.4 ^{a}	14.3 ^{c}	24.9 ^{a}	33.4 ^{c}	25.5 ^{a}
27/7/2018	18.3 ^{b}	37.5 ^{a}	45.7 ^{c}	38.5 ^{a}	11.5 ^{c}	23.1 ^{a}	30.5 ^{b}	24.3 ^{a}
Total	119.1	283.6	323.1	290.1	81.8	180.0	221.8	188.5
Mean	13.2	31.5	35.9	32.2	9.1	20.0	24.6	20.9
F(0.05)	765.34				673.25			
LSD	1.024				1.045			

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

Data obtained showed that cucumber plants which treated by low concentration of TRIA (25ppm) was lower infestation by *A. gossypii* compared to control, cucumber plants which treated by medium concentration of TRIA (35ppm) was had no significant differences compared to control and cucumber plants which treated by high concentration of TRIA was higher infestation by *A. gosspii* compared to control. Whereas mean number of aphid in control was (32.2 aphid/leaf), mean number in the first treatment (low concentration of TRIA) was (13.2 aphid/leaf), mean number in the second treatment (medium concentration of TRIA) was (31.5 aphid/leaf). And mean number of aphid in the third treatment (high infestation of TRIA) was (35.9 aphid/leaf). Also, at Qaliobya Governorate was the same trend whereas mean number of A. gossypii in control was (20.9 aphid/leaf), mean number in the first treatment (low concentration of TRIA) was (9.1 aphid/leaf), mean number in the second treatment (medium concentration of TRIA) was (20.0 aphid/leaf). And mean

number in the third treatment (high infestation of TRIA) was (24.6 aphid/leaf)

Effect of Triacontanol Hormone (TRIA) on the morphological characteristics and internal components of cucumber plants:

Data tabulated in table (2) show the effect of treated cucumber plants by different concentrations of Triacontanol Hormone (TRIA) on the morphological characteristics and internal components of these plants.

Data obtained showed that cucumber plants which treated by low concentration of TRIA (25ppm) had a good morphological characteristics such as (root length, shoot length and plant height) and also good internal components such as (total protein, total sugars, starch, amino acids and total phenols) comparing to control, cucumber plants which treated by medium concentration of TRIA (35ppm) was had no significant differences compared to control, and cucumber plants which treated by high concentration of TRIA had less quality of morphological characteristics and internal components of cucumber plants compared to control.

Table 2. Effect of treated cucumber plants by different concentrations of Triacontanol Hormone (TRIA) on the morphological characteristics and internal components of cucumber plants:

Adjective		25ppm	35ppm	55ppm	Control
Root length	(cm)	111.76 c	102.32 a	93.42 b	105.25 a
Shoot length	(cm)	161.47 c	142.45 b	133.28 b	145.21 a
Plant height	(cm)	273.23 c	244.77 a	226.70 c	250.46 a
Total protein	(mg/g)	16.79 b	11.58 a	9.25 b	13.47 a
Total sugars	(mg/g)	30.84 c	22.35 a	20.46 a	23.73 a
Strach	(mg/g)	45.65 c	32.46 b	28.78 b	33.86 a
Amino acids	(mg/g)	13.13 b	6.63 a	4.67 b	7.75 a
Total phenol	(mg/g)	11.65 c	4.64 b	2.35 c	5.86 a

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

These results agreement with those obtained by Heba, M. H. (2013) in Egypt who reported that the plants (*Zea mays*) which treatment with low concentration of triacontanol hormone (35 ppm.) was low infestation with *Euprepocnemis plorans* comparing to control. And the plants which treated with high concentration of the same hormone (50 ppm.) were high infestation with the same insect comparing to control. Kumaravelu *et al.* (2000) in India who reported that the morphological adjectives (root length, shoot length, plant height and other morphological adjectives) and physiological adjectives (protein, total sugars, starch, total phenol and other physiological adjectives) were improved when we treated plants with small and medium concentrations of triacontanol hormone (TRIA) and became better than control. And these adjectives were worse than control when we treated plants with high concentration of (TRIA), Shukla *et al.* (1992) in Netherlands studied effect of triacontanol (TRIA) at lower concentrations ongrowth, plant hormones and artemisinin yield in Artemisia annua L. and found when treated plants with (TRIA) 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 (TRIA). Also theses results agreements with those obtained by Eriksen *et al.* (1981) in Oslo (Nerweg) who reported that when treated tomato and maize plants with triacontanol (TRIA) 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. And Richard and Stanley (1991) in Michigan – United States reported that triacontanol (TRIA) increased fresh and dry weight and total reducible nitrogen (total N) of rice (*Oryza sativa* L.) seedlings. Gupta *et al.* (2015) reported the role of TRIA (triacontanol hormone) in pest control and reported that plants were treated with lower concentrations of (TRIA) were less infestation with insects than control plants. Singh (2010) recorded an efficient role of TRIA in reduction of survivorship and developmental parameters of larvae of *Spilarctia oblique* Walker upon feeding on diets containing TRIA, Referring to insecticidal activity of TRIA. From all the last, it was suggested the incorporation of TRIA in the Integrated Pest Management (IPM) modules for pest control.

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الدورالذى يلعبه هرمون تراى أكونتانول (TRIA) فى مكافحة حشرة *Aphis gossypii* التى تصيب نباتات الخيارتحت ظروف الصوب الزجاجية

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الهدف من إجراء الدراسة هو معرفة تأثير معاملة نباتات الخيار *Cucumis sativus* L. بهرمون تراى أكونتانول (TRIA) بتركيزات مختلفة على درجة الإصابة بحشرة *Aphis gossypii* وأجريت التجربة فى محافظتي الجيزة و القليوبية وذلك خلال عام 2018 على عروة الخيار الصيفية المتأخرة المزروعة خلال شهرى يونيه و يوليو تحت ظروف الصوب الزجاجية. توصلت النتائج المتحصل عليها إلى وجود تأثير واضح وفروق معنوية واضحة لإصابة نباتات الخيار المعاملة بتركيز منخفض من هرمون (TRIA) (25 جزء فى المليون) على الإصابة بحشرة من القطن حيث قل متوسط تعداد الحشرة موضع الدراسة على النباتات المعاملة بالهرمون وذلك مقارنة بالنباتات الغير معاملة (الكنترول) . بينما عند معاملة نباتات الخيار بتركيز متوسط من ذات الهرمون (35 جزء فى المليون) لم يحدث تاثير واضح أو فروق معنوية واضحة على مستوى إصابة النباتات المعاملة بالحشرة موضع الدراسة وذلك بالمقارنة بالنباتات الغير المعاملة (الكنترول). بينما عند معاملة النباتات بتركيز مرتفع من ذات الهرمون (55 جزء فى المليون) كان له تأثير سلبى واضح على مستوى إصابة نباتات الخيار بذات الحشرة حيث تزايد متوسط تعداد الحشرةعلى النباتات المعاملة وذلك مقارنة بالنباتات الغير معاملة (الكنترول). أيضا تم دراسة تأثير معاملة نباتات الخيار بنفس التركيزات المختلفة من هرمون تراي أكونتانول على أهم الصفات المورفولوجية وكذلك المكونات الداخلية لنباتات الخيارالمعاملة. 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 الخيار 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 الخيار بالتركيز المتوسط من الهرمون فأشارت النتائج المتحصل عليها إلى عدم وجود تأثير واضح للهرمون وعدم وجود فروق معنوية بين كلا من الصفات المورفولوجية و كذلك المكونات الداخلية لنباتات الخيار فى كلا من النباتات المعاملة والنباتات الغير معاملة (الكنترول). على النقيض فإن معاملة نباتات الخيار بالتركيز المرتفع من الهرمون أدى إلى إنخفاض مستوى كلا من الصفات المورفولوجية والصفات الفسيولوجية للنباتات المعاملة وذلك بالمقارنة بالنباتات الغير معاملة (الكنترول). ونستخلص من هذه الدراسة أنه يمكن التوصية بإستخدام هرمون تراي أكونتانول ليس فقط كمحفز لنمو النباتات وتحسين صفاتها المورفولوجية و محتوياتها الداخلية وإنما يمكن كذلك إدراجه فى برامج المكافحة المتكاملة للحشرات (I.P.M) وذلك بالجرعات الموصى بها فى هذه الدراسة .