International Journal of Agriculture and Plant Science
www.agriculturejournal.in
Online ISSN: 2664-7664, Print ISSN: 2664-7656
Received: 21-05-2023, Accepted: 07-06-2023, Published: 22-06-2023
Volume 5, Issue 2, 2023, Page No. 73-76

Effectiveness of treatment gladiolus bulbs by cytokinin hormone (CKs) on the physiological characteristics of gladiolus thrips, *Thrips simplex*

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Abstract

Current study was carried out to determination effectiveness of treatment gladiolus bulbs by cytokinin hormone (CKs) (three different concentrations; 15 ppm, 30 ppm and 45 ppm) on the infestation level by Gladiolus Thrips, *Thrips simplex* (Morison) (Thysanoptera: Thripidae) throughout determination its effects on the physiological characteristics of that serious pest infesting gladiolus flowers. Experiments were carried out at two different zones (governorates), El-Zohrya Garden (Cairo Governorate) and Antoniadis Garden (Alexandria Governorate) during season 2021/2022 under plastic greenhouses. Results obtained at Cairo Governorate indicated to that treatment gladiolus bulbs by low concentration of cytokinin hormone (CKs) (15ppm) before planting and sprayed it twice on gladiolus leaves after planting led to positive effect on the control process of that serious pest *T. simplex* whereas led to decrease mean population of that pest compared to control (gladiolus bulbs did not treat by successive hormone) through its negative effect on the physiological characteristics (concentration of the important substances produced by that insect). While treatment gladiolus bulbs by medium concentration of cytokinin hormone (CKs) (30 ppm) before planting and sprayed it twice on gladiolus leaves after planting led to unclear effect on the control process (non-significant) on both of mean population of *T. simplex* and also on the physiological characteristics of it. While when treatment gladiolus bulbs by high concentration of cytokinin hormone (CKs) (45 ppm) before planting and sprayed it twice on gladiolus leaves after planting led to negative effect on the control process through increasing mean population of *T. simplex* on gladiolus plants and also negative effect on the physiological characteristics of that insect compared to control. The results were achieved as the same on Alexandria Governorate.

Keywords: *Thrips simplex*, gladiolus flowers, cytokinin hormone (CKs), greenhouses, physiological changes, important substances

Introduction

Gladiolus flowers (Fam.: Iridaceae) is one of the important flowers that cultivated all over the world and it is one of the important determinant factors that effects on quantity and quality of bulb flowers in Iran, Mohamed and Seyed (2019) [8]. Also, Gladiolus is an important bulbous flower crop, commercially cultivated for its beautiful spikes used as a cut flower, Pratap and Manohar (2006) [12]. Also, Tariq *et al.* (2007) [16] indicated to that gladiolus is one of the most popular cut flowers and its production and consumption has increased all over the world. Hogan (1990) [4] indicated to that Gladiolus flowers (Fam.: Iridaceae) is a very economic flowering bulb that used as a landscape plant in the home, gardens and used in decoration due to their lovely and rich colored and long vase life. Gladiolus Thrips, *Thrips simplex* (Morison) (Thysanoptera: Thripidae) is one of the serious pests infesting gladiolus flowers and caused serious damages to quantity and quality of gladiolus crop both in open fields and under plastic green houses, Denmark and Price 2014 [1] and refereed also to that Gladiolus thrips, *T. simplex* causes deformities and discoloration of gladiolus flowers and corms (bulbs) become soft and are prone to decay. Also, Weigel and Smith 2021 [18] indicated to that Gladiolus thrips, *T. simplex* is most important pest infesting gladiolus flowers and also feeds on several other flower bulb crops such as: freesia, iris and lily. Peter and Mark (1995) [10] indicated to that Gladiolus thrips, *Thrips simplex* causes serious damages to leaves, buds and flowers of gladiolus by sucking and if flowers and buds infestation were severely damaged the flowers fail to open and dry out.

Cytokinin hormone (CKs) one of the most important plant hormones which play an important role in the many vital process inside plants such as growth, regulators process and development, Miroslav (1992) [7] who indicated also to the progress of plant biotechnology has stimulated research on the plant hormones (Cytokinin hormone CKs). Also, Sedeer *et al.* (2013) [14] referred to cytokinins are major class of plant hormones that are involved in various aspects of plant development, ranging from organ formation. Current study was carried out to determination effectiveness of treatment gladiolus bulbs by cytokinin hormone (CKs) (three different concentrations) on the infestation level by Gladiolus Thrips, *T. simplex* throughout determination its effects on the physiological characteristics of that serious pest infesting gladiolus flowers.

Materials and Methods

Experimental design

Experiments were conducted on gladiolus bulbs which planting in September month 2021 at two zones (governorates), El-Zohrya Garden (Cairo Governorate) and Antoniadis Garden (Alexandria Governorate) under plastic

greenhouses. Gladiolus bulbs were divided into four groups before planting, each group contain 100 bulb, first group immersion in low concentration of cytokinin hormone (CKs) (15ppm) for 12 hours before planting, second group immersion in medium concentration of cytokinin hormone (CKs) (30ppm) for 12 hours before planting, third group immersion in high concentration of cytokinin hormone (CKs) (45ppm) for 12 hours before planting and fourth group did not immersion in any hormone before planting. Also, the plastic green house in each zone divided into four separated parts for the four groups of gladiolus bulbs. An artificial infestation by the successive insect Gladiolus Thrips, *Thrips simplex* was done at the same time at both of the two tested zones. Normal and recommended agricultural operations were applied in both of the two zones. After appeared first leaves of gladiolus plants twice sprayed of cytokinin hormone (CKs) were done (the same successive concentrations) at the same time at both of the two successive zones between each of them 21dayes at. Directly counting and laboratory counting of the successive insect *T. simplex* (adults and nymphs) was done weekly on gladiolus plants during the period from first of October 2021 until harvest time of gladiolus flowers in March 2022 and comparison between level of the infestation by the successive insect on the different four groups of gladiolus.

Physiological analyzes of the most important internal substances produced by *T. simplex*

Insect Individuals of *T. simplex* (adults and nymphs) were taken to the insect physiology laboratory to determined concentrations of the most important internal substances produced by *T. simplex*: such as total lipids, carbohydrates, total proteins, juvenile hormone, molting hormone and important enzymes such as: Lipase, Kinase, Alpha esterase, Beta esterase, Oxidation enzymes and Digestive enzymes. These analyses were carried out on different groups of *T. simplex* which fed on gladiolus flowers treated with the successive substance cytokinin hormone (CKs) (different concentrations) compared to the control.

Statistical analysis

Effectiveness of treatment gladiolus bulbs by cytokinin hormone (CKs) on the infestation level by *T. simplex* and population fluctuation of that insect and also concentration of the most important internal substances produced by *T. simplex* were subjected to analysis of variance (ANOVA) and the means were compared by LSD test at 0.05 level, using SAS program (SAS institute, 1988) [13].

Results and Discussion

1-**Population fluctuation of *Thrips simplex* during season 2021/2022 on gladiolus plants**

Experiments were carried out on gladiolus bulbs at two different zones (governorates), El-Zohrya Garden (Cairo Governorate) and Antoniadis Garden (Alexandria Governorate) under greenhouses. Gladiolus bulbs were planted on September month 2021 at both of the two zones. Results obtained and tabulated in Table (1) and Figure (1) show population fluctuation of *T. simplex* individuals (adults and nymphs) on gladiolus plants (leaves and flowers) whereas at Cairo governorate mean number of *T. simplex* infested gladiolus plants (did not treat with any hormone) - control - was 25.4 individual/plant, mean number infested gladiolus plants (treated with low concentration of CKs hormone 15 ppm) was 15.0 individual / plant, mean number infested gladiolus plants (treated with medium concentration of hormone 30 ppm) was 23.5 individual/plant, mean number infested gladiolus plants (treated with high concentration of hormone 45 ppm) was 30.3 individual / plant. whereas at Alexandria governorate mean number of *T. simplex* infested gladiolus plants (control) was 27.7 individual/plant, mean number infested gladiolus plants (treated with low concentration of CKs hormone) was 16.0 individual /plant, mean number infested gladiolus plants (treated with medium concentration of hormone) was 25.8 individual/plant,mean number infested gladiolus plants (treated with high concentration of hormone) was 32.5 individual / plant. Statically analysis show that were highly significant differences between mean numbers of *T. simplex* individuals infested gladiolus plants which treated with successive hormone CKs (low and high concentrations) compared to control. Whereas $F_{0.05}$ and L.S.D values at Cairo Governorate were (345.72, 1.023) respectively while in Alexandria Governorate $F_{0.05}$ and L.S.D values were (415.83, 1.035) respectively. And statically analysis show also that

Table 1: Population fluctuation of *T. simplex* during season 2021/2022 on gladiolus plants at Cairo and Alexandria governorates

Date	Cairo Governorate				Alexandria Governorate			
	15 ppm	30 ppm	45 ppm	Control	15 ppm	30 ppm	45 ppm	Control
1/10/2021	3.5	7.5	13.5	9.3	2.6	10.9	14.5	12.4
8/10/2021	4.7	9.0	14.9	11.2	2.6	12.4	15.0	14.3
15/10/2021	4.5	12.6	15.5	13.4	3.7	14.2	16.0	15.5
22/10/2021	5.9	14.5	17.3	15.7	4.7	16.8	18.8	17.8
29/10/2021	6.4	15.5	20.7	16.8	6.4	17.7	20.7	18.8
5/11/2021	8.3	17.5	21.4	18.2	7.3	19.4	23.3	20.2
12/11/2021	9.3	18.3	23.3	19.3	8.3	20.1	25.9	21.3
19/11/2021	10.0	19.1	25.9	20.1	8.0	21.4	27.4	22.1
26/11/2021	12.2	20.5	27.5	21.5	10.2	22.2	29.0	23.5
3/12/2021	13.0	21.0	28.6	23.0	11.0	23.0	31.2	24.0
10/12/2021	14.2	23.1	29.1	25.1	12.2	25.1	33.5	27.1
17/12/2021	17.2	24.8	31.5	26.8	14.2	26.8	34.9	28.8
24/12/2021	18.3	26.3	33.8	28.3	16.3	28.3	36.2	30.3
31/12/2021	19.3	27.0	34.7	29.0	18.3	29.0	37.1	31.0
7/1/2022	20.5	28.5	36.0	30.5	19.5	30.5	39.2	32.5
14/1/2022	20.4	29.7	37.0	31.7	20.4	31.7	40.3	33.7
21/1/2022	21.5	30.9	38.5	32.9	21.5	32.9	42.6	35.9
28/1/2022	22.0	30.8	40.0	33.8	22.0	33.8	43.1	36.8

4/2/2022	23.3	32.0	41.6	35.0	23.3	35.0	45.7	38.0
11/2/2022	24.0	35.2	43.7	37.2	24.0	37.2	46.2	40.2
18/2/2022	25.5	36.0	45.0	39.0	25.5	39.0	47.0	42.0
25/2/2022	26.0	37.2	47.1	40.2	26.0	40.2	48.1	43.2
Total	330.0	517.0	666.6	558.0	352.0	567.6	715.0	609.4
Mean	15.0	23.5	30.3	25.4	16.0	25.8	32.5	27.7
F(0.05)	345.72				415.83			
L.S.D	1.023				1.035			
%	40.9	7.5	16.2	-	42.2	6.9	14.8	-

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

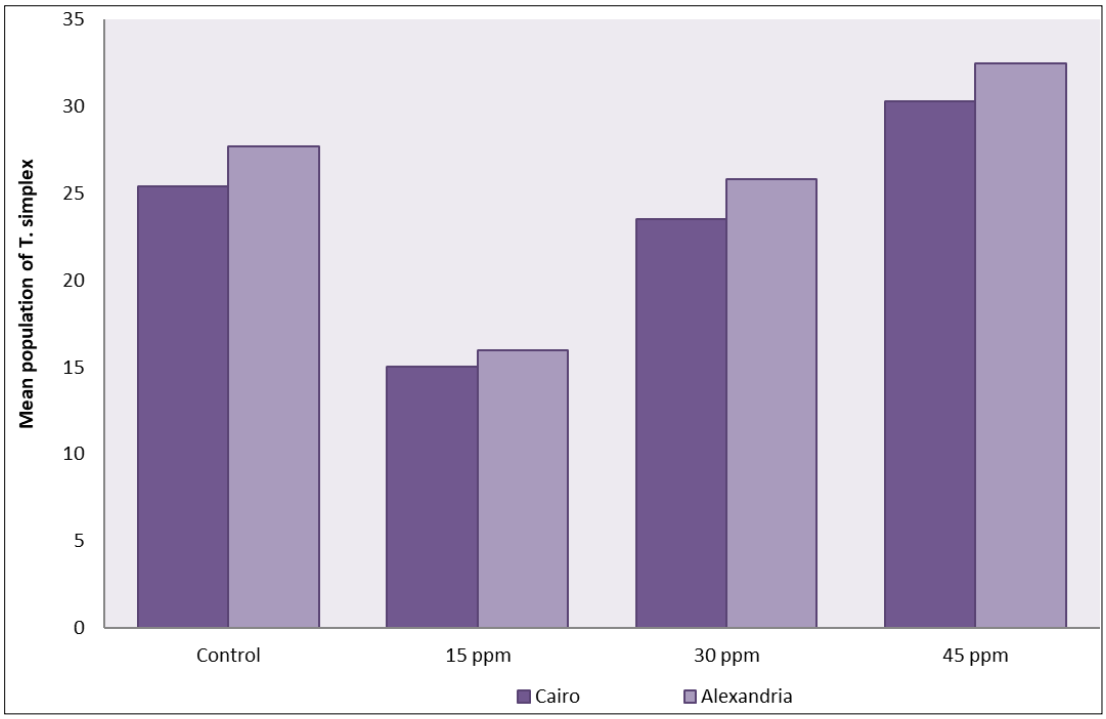

Fig 1: Population mean of *T. simplex* during season 2021/2022 on gladiolus plants at Cairo and Alexandria governorates

were not significant differences between mean number of *T. simplex* individuals infested gladiolus plants which treated with medium concentration of successive hormone CKs (30 ppm) compared to control at both of the two successive zones.

2-Effectiveness of cytokinin hormone (CKs) on the internal substances produced by *T. simplex*

Results obtained and tabulated in Table (2) show effectiveness of treatment gladiolus bulbs by cytokinin hormone (CKs)(three concentrations) before planting and other two spayed of that hormone after planting on the internal substances produced by *T. simplex*

Table 2: Effectiveness of cytokinin hormone (CKs) on the internal substances produced by *T. simplex* during season 2021/2022

Parameters	15 ppm	30 ppm	45 ppm	Control	$F_{0.05}$	LSD
Total Lipids (mg/100g)	10.3 c	12.0 a	14.2 b	12.3 a	325.15	1.025
Carbohydrates (mg/100g)	5.9 c	7.0 a	9.1 b	7.5 a		
Total proteins (mg/100g)	23.0 c	24.9 a	27.5 b	25.7 a		
Juvenile hormone (mg/100g)	10.9 c	12.2 a	14.1 b	12.5 a		
Molting hormone (mg/100g)	7.5 c	9.2 a	10.3 b	9.8 a		
Lipase Enzyme (mg/100g)	25.3 c	26.9 a	29.1 b	27.5 a		
Kinase Enzyme (mg/100g)	16.0 c	17.8 a	19.6 b	18.5 a		
Alpha Esterase (mg/100g)	8.5 c	9.5 a	11.9 b	10.8 a		
Beta Esterase (mg/100g)	7.3 c	8.2 a	10.8 b	9.5 a		
Oxidation enzymes (mg/100g)	5.9 c	6.5 a	9.2 b	7.8 a		
Digestive enzymes (mg/100g)	6.5 c	7.3 a	10.5 b	8.2 a		

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

;(total lipids, carbohydrates, total proteins, Juvenile hormone, molting hormone and important enzymes such as; Lipase, Kinase, Alpha esterase, Beta esterase, Oxidation enzymes and Digestive enzymes). Results obtained show that when treatment gladiolus bulbs with low concentration of CKs (15 ppm) before planting and other two sprayed of that hormone after planting led to negative effectiveness on that substances produced by successive insect *T. simplex* compared to control. While when treatment gladiolus bulbs with medium concentration of CKs (30 ppm) before

planting and other two sprayed of that hormone after planting led to unclear effectiveness (non-significant) on that substances produced by successive insect *T. simplex* compared to control. While when treatment gladiolus bulbs with high concentration of CKs (45 ppm) before planting and other two sprayed of that hormone after planting led to positive effectiveness on that substances produced by successive insect *T. simplex* compared to control.

Statically analysis show that were highly significant differences between concentrations of that internal substances which produced by *T. simplex* when treatment gladiolus bulbs with low and high concentration of the successive hormone compared to control whereas $F_{0.05}$ and L.S.D values were (325.15, 1.025) respectively. While when treatment gladiolus bulbs with medium concentration of the successive hormone there were not significant differences between concentrations of that internal substances which produced by *T. simplex* compared to control.

These obtained results were agreement with those obtained by Jaskiewicz (2015) [6] in Poland who indicated to that serious infestation by Gladiolus Thrips, *T. semplex* on gladiolus flowers led to deformation of the leaf blades and flowers petioles. Pollard (2016) [11] who indicated that *T. simplex*

infestation concentration on gladiolus flowers whereas its nymphs when feeding penetration gladiolus leaf epidermis and make serious damages to flowers. Peng and Miles (2015) [9] in Australia refereed to that *T. simplex* infestation concentration on gladiolus flowers and specially feeding in the parenchymal and vascular tissues of the gladiolus flowers. Gupta *et al.* (2009) [3] indicated to the importance of CKs (Cytokinin Hormone) in controlling operation of many pests throughout its positive effectiveness on the plants healthy. Shukla *et al.* (2013) in Netherlands indicated to the effect of cytokinin hormone (CKs) specially at lower concentrations on plants growth and its effects on the plant healthy and indirectly effect on the reduce numbers of many pests infesting these plants. Ivo *et al.* (2011) [5] indicated to that cytokinin hormones are important regulators of development and environmental responses of plants. Eriksen *et al.* (2015) [2] in Oslo (Nerweg) indicated that when treatment tomato plants with Cytokinin (CKs) led to positive effectiveness in the dry weight of the tomato plants and other different stages of development. Shukla *et al.* (2013) [15] in Netherlands indicated to effect of cytokinin hormone (CKs) specially at low concentrations on some vital processes such as; growth, yield production etc,,. Also, Tomas and Thomas (2009) [17] indicated to that cytokinin hormone play an important role in the plant development and growth.

Conclusion

Current study indicated to effectiveness of cytokinin hormone (CKs) on the infestation level by Gladiolus Thrips, *Thrips simplex* throughout its effects on the physiological characteristics (internal substances) produced by that serious pest infesting gladiolus flowers. Results obtained indicated that treatment gladiolus bulbs by low concentration of that hormone (15 ppm) led to positive effectiveness on the control process of that pest compared to control while treatment these bulbs by medium concentration of the same hormone (30 ppm) led to anclear effectiveness (non-significant) on the control process compared to control and treatment these bulbs by high concentration of the same hormone (45 ppm) led to negative effectiveness on the control process of that pest compared to control. Therefore, we recommended in this study the inclusion cytokinin hormone CKs (with the recommended concentrations) in the recent integrated pest managements programs (I.P.M).

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