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Effect of the Insect Infestation by *Thrips simplex* and *Macrosiphum rosae* on the Morphological Characteristics of Gladiolus Flowers Under Plastic Greenhouses

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ABSTRACT

This study was carried out to study the effect of the insect infestation by Gladiolus Thrips, *Thrips simplex* (Morison) (Thysanoptera: Thripidae) and The Rose Aphid, *Macrosiphum rosae* L. (Hemiptera: Aphididae) on the morphological characteristics of gladiolus flowers (Fam.: Iridaceae). This study was carried out at two locations (governorates), Al-Orman Garden (Giza Governorate) and Antoniadis Garden (Alexandria Governorate) during season 2021 under plastic greenhouses. Some morphological characteristics were studied such as color of the flower, number of the petals per flower, length of the flower diameter, weight of the flower, the stem length, the vase life period (flowers life after picking) and the annual production for flowers.

Results obtained showed that the infestation by thrips and aphids affected on all morphological characteristics of gladiolus flowers except the color of the flower. And data obtained showed also that the effect of the infestation by aphids was higher than the effect of thrips compared to control (flowers did not infest by any insects).

INTRODUCTION

Gladiolus flowers (Fam.: Iridaceae) consider one of the most important cut flowers in Egypt and all over the world. It's used for most decorations and landscape purposes, and it considers an essential element of most flowers bunches (Denmark and Price 2014). Humans love gladiolus flowers due to their beautiful colors, style of flowers, smiles, and tolerance of the inferable weather factors, gladiolus is represented by 180 species and 10000 cultivars including almost all colors (Kumar and Arora 2015).

Gladiolus Thrips, *Thrips simplex* (Morison) (Thysanoptera: Thripidae) consider one of the most dangerous pests to gladiolus plants which caused serious damage to gladiolus plants both leaves and flowers. (Denmark and Price 2014). Also, Decheva *et al.* (2003) in Bulgaria investigated the changes in the gladiolus flowers after the infestation by *T. simplex* and found that insect causes serious damage to these flowers.

The Rose Aphid, *Macrosiphum rosae* L. (Hemiptera: Aphididae) also consider one of the most dangerous pests of gladiolus plants both leaves and flowers, Pal and Sarkar (2009). Also, Atwal and Dhingra (2012) reported that the infestation by *M. rosae* was affected seriously in the gladiolus petals especially the recent petals.

This study was carried out to study the effect of the insect infestation by Gladiolus Thrips, *T. simplex* and The Rose Aphid, *M. rosae* on the morphological characteristics of gladiolus flowers. This study was carried out at two locations (governorates) Al-Orman

Garden (Giza Governorate) and Antoniadis Garden (Alexandria Governorate) during season 2021 under plastic greenhouses.

MATERIALS AND METHODS

Experimental Design:

This study was carried out on gladiolus plants in two locations (governorates), Al-Orman Garden (Giza Governorate) and Antoniadis Garden (Alexandria Governorate) during season 2021 under plastic greenhouses. Four colors (varieties) of gladiolus were tested (red, yellow, pink and white). The greenhouse in both of the two gardens with an area of 27x45 m. Each greenhouse was divided into four arias for the four tested colors of gladiolus, each aria contains one color of gladiolus. And each aria was divided into three parts, first part was left as control, the second part had artificially infestation by Gladiolus Thrips, *Thrips simplex* (Morison) and the third part had artificially infestation by The Rose Aphid, *Macrosiphum rosae* L. each part contains 5 plots (3x5 m²) for each, and each part isolated completely from others. The gladiolus seedlings were planted in glasshouse conditions at the same time in March month (the planting time of gladiolus plants). All agricultural operations of irrigation and fertilization and others are completely identical in the two glasshouses were done without the application of any insecticide.

At both of the two plastic greenhouses all post-harvest treatments were identical but conducted separately until the arrival of the flowers for the final stage, then took these flowers to the laboratory. At the end of the first growing season, 50 flowers were collected from each part at the two locations and all morphological parameters were carried out of them at the laboratory.

Laboratorial Design:

These experiments were carried out to study the effect of both the two tested insects on the morphological characteristics of gladiolus flowers. Morphological characteristics studied were: color of the flower, number of the petals per flower, the flower diameter, weight of the flower, the stem length, the vase life period (flowers life after picking) and the annual production. And these experiments were carried out also to study the effect of the two insects on the interior tissues of gladiolus petals especially the vascular bundles which consider the main food factory of the flowers and all the plants.

Statistical Analysis:

Effect of the insect infestation by both Gladiolus Thrips *T. simplex* and The Rose Aphid, *M. rosae* on the morphological characteristics of certain gladiolus varieties 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).

RESULTS AND DISCUSSION

This study was carried out to study the effect of the insect infestation by Gladiolus Thrips, *Thrips simplex* (Morison) (Thysanoptera: Thripidae) and The Rose Aphid, *Macrosiphum rosae* L. (Hemiptera: Aphididae) on the morphological characteristics of gladiolus flowers (Fam.: Iridaceae). This study was carried out at two locations (governorates), Al-Orman Garden (Giza Governorate) and Antoniadis Garden (Alexandria Governorate) during season 2021 under plastic greenhouses.

Giza Governorate:

Data tabulated in Table (1) show the effect of the insect infestation by *T. simplex* and *M. rosae* on some morphological characteristics of gladiolus flowers such as (color of the flower, number of the petals per flower, the flower diameter, weight of the flower, the

stem length, the vase life period and the annual production of flowers) at Giza Governorate during season 2021. Data obtained showed that was not any change in the color of the gladiolus flower after the infestation by both *T. simplex* and *M. rosae*, but the other tested characteristics changed clearly change after infestation by both the two tested insects. And data obtained showed also that the effect of the infestation by *M. rosae* was higher than the effect of the infestation by *T. simplex*

Alexandria Governorate:

Data tabulated in Table (2) show the effect of the insect infestation by *T. simplex* and *M. rosae* on the morphological characteristics of gladiolus flowers at Alexandria Governorate during season 2021. Data obtained showed that was not any change in the color of the gladiolus flower after the infestation by both the two insects, but the other tested characteristics changed clearly change after infestation by both the two tested insects. And data obtained showed also that the effect of the infestation by *M. rosae* was higher than the effect of the infestation by *T. simplex*. Statistical analyses showed that were highly significant differences between the parameters of the morphological characteristics of gladiolus flowers (except the color of the flower) which infested by both the two tested insects *T. simplex* and *M. rosae* compared to control (flowers non-infested by any insects).

Table 1: Effect of the infestation by aphid and thrips on the morphological characteristics of gladiolus flowers at Giza Governorate during 2021 season

Adjective	Red			SA	Yellow			SA	Pink			SA	White			SA
	Control	Aphid	Thrips		Control	Aphid	Thrips		Control	Aphid	Thrips		Control	Aphid	Thrips	
Colour	Red	Red	Red	ns	Yellow	Yellow	Yellow	ns	Pink	Pink	Pink	ns	White	White	White	ns
No. of Petals/flower	20	12	15	F=2.32* LSD=1.25	18	11	14	F=8.25** LSD=1.15	19	12	15	F=6.07* LSD=1.32	21	13	16	F=7.35** LSD=1.25
Flower diameter/cm	10	6	8	F=8.71** LSD=1.25	9	5	7	F=9.45** LSD=1.22	11	6	8	F=7.55** LSD=1.13	9	5	7	F=9.55** LSD=1.43
Weight/g	17	12	14	F=12.51** LSD=1.98	19	13	15	F=8.25* LSD=1.09	18	12	14	F=11.01** LSD=1.07	17	11	13	F=12.31** LSD=1.08
Stem length/cm	25	17	20	F=12.24** LSD=1.06	27	20	22	F=8.41** LSD=1.12	26	19	21	F=11.09** LSD=1.08	25	18	21	F=12.15** LSD=1.59
Vase life/day	9	5	7	F=12.26* LSD=1.16	8	4	6	F=15.21** LSD=1.06	10	6	8	F=8.23** LSD=1.08	9	5	7	F=9.24** LSD=1.53
Annual production flower/m ² /year	125	85	97	F=13.43*** LSD=1.09	120	80	95	F=12.44** LSD=1.21	115	80	90	F=17.52*** LSD=1.05	122	87	101	F=14.01** LSD=1.25

SA = Statistical analysis ns - non significant * - significant ** - significant *** - high significant

Table 2: Effect of the infestation by aphid and thrips on the morphological characteristics of gladiolus flowers at Alexandria Governorate during 2021 season

Adjective	Red			SA	Yellow			SA	Pink			SA	White			SA
	Control	Aphid	Thrips		Control	Aphid	Thrips		Control	Aphid	Thrips		Control	Aphid	Thrips	
Colour	Red	Red	Red	ns	Yellow	Yellow	Yellow	ns	Pink	Pink	Pink	ns	White	White	White	ns
No. of Petals/flower	22	15	18	F=12.02* LSD=1.07	21	14	17	F=9.17** LSD=1.25	20	13	15	F=17.08* LSD=1.12	19	12	14	F=15.21** LSD=1.23
Flower diameter/cm	12	6	8	F=12.31** LSD=1.09	11	6	7	F=14.22** LSD=1.16	10	5	7	F=15.31** LSD=1.03	11	6	8	F=13.41*** LSD=1.53
Weight/g	18	12	15	F=14.31** LSD=1.08	17	11	14	F=8.23* LSD=1.29	19	13	15	F=13.51** LSD=1.37	18	12	14	F=14.71** LSD=1.58
Stem length/cm	27	20	23	F=12.24** LSD=1.26	25	19	22	F=7.45** LSD=1.32	26	20	23	F=12.33** LSD=1.58	25	18	21	F=12.32** LSD=1.75
Vase life/day	8	4	6	F=14.32* LSD=1.06	9	5	7	F=13.05** LSD=1.35	10	5	8	F=8.25** LSD=1.28	8	4	6	F=9.24* LSD=1.52
Annual production flower/m ² /year	121	80	95	F=13.23*** LSD=1.09	124	85	98	F=12.44** LSD=1.35	115	76	88	F=11.05*** LSD=1.25	120	83	99	F=14.21** LSD=1.05

SA = Statistical analysis ns - non significant * - significant ** - significant *** - high significant

The obtained results are in agreement with those obtained by Jaskiewicz (2015) in Poland who studied the effect of feeding of Gladiolus Thrips, *T. simplex* on the flowering of gladiolus flowers and reported that *T. simplex* when found in greater numbers caused deformation of the leaf blades, the shorting of shoots and flowers petioles, as well as deformation of the flowers. Also, Pham *et al.* (2012) in the Netherlands who studied the effect of *Frankliniella occidentalis* on gladiolus plants, and stated that flower damage caused by *F. occidentalis* depends on the season and number of thrips on the flower and

conducted a study to determine the relationship among silver damage on the leaves and flower damage, and Sauer (2015) in Germany reported that petal damage could not always be attributed to thrips infestation (number of thrips) only but also attributed to the time of the infestation, total infestation percentages depending on the average colonization /week. Also, Baradara *et al.* (2001) reported that The Rose Aphid, *Macrosiphum rosae* consider one of the serious pests to gladiolus flowers and causes many damages to these flowers. And Pal and Sarkar (2009) reported that The Rose Aphid, *Macrosiphum rosae* was very important causing havoc to gladiolus plants and it causes serious damages to these plants by feeding on the leaves and flowers. Also, Hole *et al.* (2015) studied the effect of The Rose Aphid, *Macrosiphum rosae* on some ornamental plants (Rose, Gladiolus and Tulip) and referred to the seriously damages in the flowers as a result of this infestation.

Effect of the Insect Infestation by Thrips and Aphid on The Vascular Bundles:

The obtained results showed that the effect of *T. simplex* and *M. rosae* concentration on the vascular bundles in the tissue of the petals of gladiolus flowers which consider the factory of the food in the plant. And the damage in these vascular bundles increases with the high infestation by the two insects and decreases with the low infestation by them. This is shown clearly from Figure (1) which show cross-sections for petals of gladiolus flowers and show the effect of infestation by thrips and aphid concentration on the vascular bundles (bundle sheath, xylem vessels and phloem), which make an important role in transporting water and nutrient from soil to plants and from leaves to all parts of the gladiolus plant. And the figure shows that by increasing the infestation with the two tested insects, the damage in vascular bundles increase and vice versa. And the figure showed also that the effect of *M. rosae* was higher than the effect of *T. simplex* on the vascular bundles.

The obtained results are in agreement with those obtained by Pollard (2016) who studied the feeding penetration of *Thrips simplex* nymphs into gladiolus leaf epidermis, as shown by a study of stylets and tracks, maybe intercellular, or stomatal with the former predominating, and reported also that the contact between the stylet sheath or track and cell cytoplasm is at a maximum during intracellular entry. Also, the obtained results are in agreement with those obtained by Peng and Miles (2015) in Australia, detected that *T. simplex* feeding on the gladiolus flowers that occurs and concentration in the parenchymal and vascular tissues of the gladiolus flowers tissues and thrips will feed on tissues and on aqueous diets containing low concern. of catechin. Davidson (2014) reported that the plant exhibits many pathological features as a result of thrips attack, the food of thrips is the cell sap of plants derived from various cells of the plant tissues especially the vascular bundles. Also, Murugan and Jagadish (2016) studied the effect of the feeding and behavior of the thrips, *Frankinella tritici* and found that pests found only on the vascular bundles. Kindt *et al.* (2013) studied characterization of the feeding behavior of Western flower thrips (Ornamental plants thrips) *Frankliniella occidentalis* (Pergande) and found that insect causes damage to plants when it is feeding, also this thrips species investigated that the penetration behavior (probing) of thrips on leaves causes more damage on vascular bundles. Halder and Seni (2020) reported that The Rose Aphid, *Macrosiphum rosae* both nymphs and adults cause discoloration and deformities of gladiolus flowers by feeding on flower spikes and corms. Becker and Apel (2005) reported that the effect of The Rose Aphid, *M. rosae* on some ornamental plants and referred to the effect of this insect concentration on the vascular bundles of these plants' flowers.

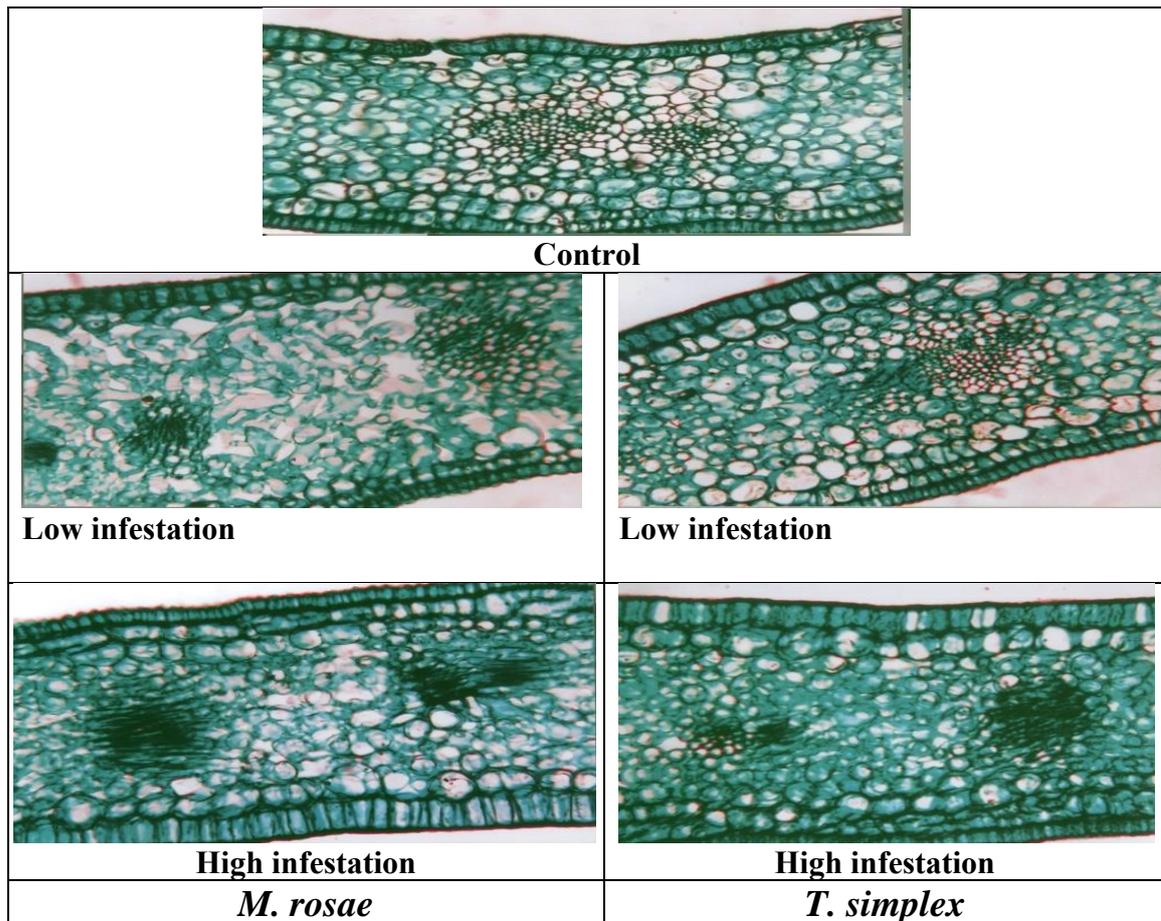


Fig. 1: The damage symptoms of gladiolus flowers tissues (vascular bundles) after infestation by *T. simplex* and *M. rosae*

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ARABIC SUMMARY

أثر الإصابة الحشرية بتربس الجلاديولس *Thrips simplex* ومن الورد *Macrosiphum rosae* على الصفات المورفولوجية لأزهار الجلاديولس تحت ظروف الصوب البلاستيكية

منى نصر وهبه يوسف ، هيام مصطفى سعد ، محمد إسماعيل حسن و أشرف صلاح إمام
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة - 12618 مصر

أجريت هذه الدراسة بغرض دراسة تأثير كلا من حشرتي تربس الجلاديولس *Thrips simplex* ومن الورد *Macrosiphum rosae* على بعض الصفات المورفولوجية لأزهار الجلاديولس تحت ظروف الصوب البلاستيكية. وذلك في موقعين (محافظتين) مختلفتين هما حديقة الأورمان (محافظة الجيزة) وحديقة أنطونيداس (محافظة الإسكندرية) خلال موسم 2021

شملت الدراسة بعض الصفات المورفولوجية الهامة لأزهار الجلاديولس مثل : لون الزهرة , عدد البتلات التي تحتويها الزهرة , طول قطر الزهرة , وزن الزهرة , طول عنق الزهرة , طول فترة حياة الزهرة بعد القطف , متوسط الانتاج الموسمي للأزهار. وذلك عن طريق المقارنة بين هذه الصفات المورفولوجية لأزهار الجلاديولس المصابة بحشرات تربس الجلاديولس وأيضا الأزهار المصابة بمن الورد ومقارنتهما بأزهار الجلاديولس المنتجة الخالية من الإصابة بكلتا الحشرتين.

أشارت النتائج المتحصل عليها إلى تأثير الصفات المورفولوجية لأزهار الجلاديولس (باستثناء لون الزهرة فقط) بالإصابة الحشرية بكلا من حشرة تربس الجلاديولس *T. simplex* ومن الورد *M. rosae* وكان تأثير الإصابة بحشرة من الورد أكثر وضوحا من تأثير الإصابة بحشرة تربس الجلاديولس وذلك بالمقارنة بأزهار الجلاديولس السليمة الخالية من الإصابة بكلتا الأفتين محل الدراسة.

كما أشارت الدراسة إلى تركيز الإصابة بكلتا الأفتين التربس والمن على منطقة الحزم الوعائية الموجودة في أنسجة بتلات أزهار الجلاديولس وظهر ذلك واضحا عند عمل قطاعات عرضية في بتلات أزهار الجلاديولس حيث ظهر من هذه القطاعات تركيز الإصابة بكلتا الأفتين على منطقة الحزم الوعائية كما ظهر منها أيضا أنه كلما ازدادت درجة الإصابة بأى من الأفتين كلما كان التأثير أكثر وضوحا على الحزم الوعائية. كما أشارت الدراسة كذلك إلى أن تأثير الإصابة بحشرة من الورد كان أكثر وضوحا من تأثير الإصابة بحشرة تربس الجلاديولس على تلك الحزم الوعائية.