



Effect of insect infestation by *Macrosiphoniella sanborni* (Hemiptera: Aphididae) and *Frankliniella tritci* (Thysanoptera: Thripidae) on morphological characteristics of chrysanthemum flowers under glasshouse

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Abstract:

The aim of this research work is to study the comparison between effects of insect infestation by chrysanthemum aphid *Macrosiphoniella sanborni* (Gillete) (Hemiptera: Aphididae) and ornamental plant thrips *Frankliniella tritci* (Fitch) (Thysanoptera: Thripidae) on some morphological characteristics of chrysanthemum flowers under glasshouse conditions at two locations in Cairo and Giza Governorates during 2018 seasons. Morphological characteristics which studied were, color of the flower, number of the petals per flower, the flower diameter, weight of the flower, the stem length, vase life period (flowers life after picking) and annual production. Results showed that the infestation by *M. sanborni* (Aphid) and *F. tritci* (Thrips) affected on all morphological characteristics except the color of the flowers. The effect of infestation by aphid was higher than the effect of infestation by thrips, this is compared to control (chrysanthemum flowers did not infested by any insects). Also, present study showed clearly that the effect of aphid and thrips infestation concentration on the vascular bundles of the flowers petals and with the increase in the infestation by the two insects and the damage in the vascular bundles increases.

Introduction

Chrysanthemums flowers are very important cut flowers crop with an economical value in international floral industry. Chrysanthemum has long post harvest life and it continues to look attractive even when semi dry. It has wide range of colors, shapes and sizes. Chrysanthemum is ranked as the second most economic important cut flower in the world after rose (Kafi and Ghahsareh, 2009).

Chrysanthemum flowers infested different species of insects causes much damages to the flowers both to its quantity and quality. Chrysanthemum aphid *Macrosiphoniella sanborni* (Gillette) (Hemiptera: Aphididae) is one of the most dangerous insect pests infesting chrysanthemum flowers. Chrysanthemum aphid *M. sanborni*) had caused great damage to chrysanthemum production and affected seriously on the flowers in

quantity and quality (Sumei *et al.*, 2014). Chrysanthemum aphid *M. sanborni* represent the most destructive of chrysanthemum pests to cultivation and caused many damage to the flowers and production (Yanming *et al.*, 2010 and Wang *et al.*, 2015).

Also, ornamental plant thrips *Frankliniella tritci* (Fitch) (Thysanoptera: Thripidae) is considered as one of the most dangerous insects infested chrysanthemum flowers both in open field and under glasshouse conditions. Candica *et al.* (2012) reported that thrips insects cause damage to chrysanthemum flowers growth under glasshouse conditions. Carl and Diann (2015) studied the injury to various plant tissues by ovipositing thrips and feeding injuries by thrips species to pollen, flowers, fruit and leaves are characterized for different economic plants. Murugan and Jagadish (2014) in India reported that chilli thrips *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) has become a serious pest on chrysanthemum flowers in recent times. It feeds all stages of chrysanthemum flowers by remaining concealed between the petals. They reported four stages of chrysanthemum flowers, unopened buds, opened young buds, harvestable flowers and fully opened flowers.

This research work was carried out to study the comparison between effect of insect infestation by chrysanthemum aphid *M. sanborni* and ornamental plant thrips *F. tritci* on some morphological characteristics of chrysanthemum flowers under glasshouse conditions at two locations in Cairo and Giza Governorates during 2018 season.

Materials and methods

1. Experimental design:

This study was conducted on chrysanthemum plants grown in two locations, International Garden (Cairo Governorate) and El-Orman Garden,

(Giza Governorate) under glasshouse conditions during successive seasons 2018. The glasshouse in each garden with an area of 27x45 m. Each glasshouse was divided into three parts, first part left as control, second part had artificially infestation by chrysanthemum aphid *M. sanborni* and the third part had artificially infestation by ornamental plant thrips *F. tritci*. Each part contains 5 plots (3x5 m²) for each, and each part isolated completely from others. Chrsanthemum seedlings were planted in glasshouse conditions at the same time on September (the planting time of chrysanthemum plants). All agricultural operations of irrigation and fertilization and others are completely identical in the two glasshouses were done without application of any insecticide.

At both of the two glasshouses all postharvest 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 carried out of them at the laboratory.

2. Laboratorial design:

This experiment was carried out also to study the effect of both the two studied insects on the morphological characteristics of chrysanthemum 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, vase life period (flowers life after picking) and annual production. Also effect of the two insects on the interior tissues of chrysanthemum betals especially the vascular bundles which consider the food factory of the flowers and all the plant.

3. Statistical analysis:

Effect of the insect infestation by both chrysanthemum aphid *M. sanborni* and ornamental plant thrips *F. tritci* on the morphological characteristics of certain chrysanthemum 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

1. Effect of infestation by *Macrosiphoniella sanborni* and *Frankliniella tritci* on the morphological characteristics of chrysanthemum flowers:

Data tabulated in Table (1) showed the effect of insect infestation by aphid *M. sanborni* and thrips *F. tritci* on some morphological characteristics of chrysanthemum flowers for different varieties (colors) compared to control which non infested by these insects. The results showed that red flowers, the color not changed after infestation by the two insects. Number of petals per flower decreased from 50-55 petals/flower in control to 37-39 and 41-43 petals/ flower; the flower diameter changed from 8-10 cm in control to 4-5 and 5-6 cm ; weight of the flower also decreased from 15-17 gram in control to 10-12 and 12-14 gram ; the stem length decreased from 25-30 cm in control to 17-19 and 20-22 cm ; the vase life period decreased from 8-11 days in control to 4-5 and 5-6 days and the annual production reached to 125-130 flower/m²/year in control but decreased to 85-90 and 90-95 flower/m²/year after infestation by *M. sanborni* and *F. tritci* , respectively. For (Yellow flowers), the color not changed after infestation by the two insects. Number of petals per flower decreased from 45-50 petals/flower in control to 31-33 and 36-39 petals/flower ; the flower diameter changed from 9-11 cm in control to 5-6 and 6-7 cm ; weight of

the flower also decreased from 17-19 gram in control to 11-13 and 14-15 gram ; the stem length decreased from 27-31cm in control to 19-21 and 22-24 cm ;the vase life period decreased from 9-11 days in control to 5-7 and 6-8 days and the annual production reached to 120-125 flower/m²/year in control, but decreased to 85-90 and 90-95 flower/m²/year after infestation by *M. sanborni* and *F. tritci* , respectively.

For (blue flowers), the color not changed after infestation by the two insects. Number of petals per flower decreased from 47-50 petals/flower in control to 35-37 and 38-40 petals/flower ; the flower diameter changed from 10-12 cm in control to 6-8 and 7-9 cm ; weight of the flower also decreased from 16-18 gram in control to 10-12 and 12-14 gram ; the stem length decreased from 28-32cm in control to 20-22 and 23-24 cm ; the vase life period decreased from 10-12 days in control to 5-6 and 7-8 days and the annual production reached to 115-120 flower/m²/year in control, but decreased to 80-85 and 85-90 flower/m²/year after infestation by *M. sanborni* and *F. tritci* , respectively. For (White flowers), the color not changed after infestation by the two insects. Number of petals per flower decreased from 48-52 petals/flower in control to 33-35 and 38-41 petals/flower ; the flower diameter changed from 9-11 cm in control to 5-7 and 6-8 cm ; weight of the flower also decreased from 17-19 gram in control to 10-12 and 13-15 gram ; the stem length decreased from 26-30 cm in control to 18-20 and 22-23 cm ;the vase life period decreased from 9-11 days in control to 5-6 and 7-9 days and the annual production reached to 120-125 flower/m²/year in control, but decreased to 85-90 and 90-95 flower/m²/year after infestation by *M. sanborni* and *F. tritci* , respectively.

Table (1) : Effect of infestation by *Macrosiphoniella sanborni* and *Frankliniella tritci* on the morphological characteristics of chrysanthemum flowers.

Adjective	Red			SA	Yellow			SA	Blue			SA	White			SA
	Control	Aphid	Thrips		Control	Aphid	Thrips		Control	Aphid	Thrips		Control	Aphid	Thrips	
Colour	Red	Red	Red	ns	yellow	yellow	yellow	ns	Blue	blue	blue	ns	White	White	white	ns
No. of Petals/flower	50-55	37-39	41-43	F =2.52* LSD=6.17	45-50	31-33	36-39	F=9.27** LSD=6.25	47-50	35-37	38-40	F=7.08* LSD=7.12	48-52	33-35	38-41	F=15.31** LSD=6.23
Flower diameter/cm	8-10	4-5	5-6	F=12.01** LSD=1.29	9-11	5-6	6-7	F=14.00** LSD=1.26	10-12	6-8	7-9	F=15.01** LSD=2.03	9-11	5-7	6-8	F=13.01*** LSD=1.43
Weight/g	15-17	10-12	12-14	F=14.01** LSD=1.98	17-19	11-13	14-15	F=8.03* LSD =1.99	16-18	10-12	12-14	F=13.01** LSD=1.97	17-19	10-12	13-15	F=14.01** LSD=1.88
Stem length/cm	25-30	17-19	20-22	F=22.14*** LSD=7.56	27-31	19-21	22-24	F=7.41** LSD =7.82	28-32	20-22	23-24	F=12.00** LSD =8.78	26-30	18-20	22-23	F =12.0** LSD=8.79
Vase life/day	8-11	4-5	5-6	F =14.36* LSD =2.36	9-11	5-7	6-8	F=13.01** LSD =2.36	10-12	5-6	7-8	F =8.03** LSD=1.58	9-11	5-6	7-9	F =9.4* LSD=1.57
Annual production flower/m ² /year	125-130	85-90	90-95	F=53.03*** LSD=8.59	120-125	85-90	90-95	F=32.74** LSD=12.31	115-120	80-85	85-90	F=32.5*** LSD=13.15	120-125	85-90	90-95	F=14.01** LSD=15.35

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

The obtained results are agreement with those obtained by Jaskiewicz (2016) in Poland who studied the effect of feeding of chrysanthemum aphid, *M. sanborni* on the flowering of chrysanthemum and reported that the *M. Sanborni* 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.* (2008) in Netherlands who studied the effect of *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) on chrysanthemum 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 (2012) 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. On the other side, Gary *et al.* (2015) found that the aphid has not only direct effect on chrysanthemum flowers but also has indirect effect on these flowers through transmitted virus diseases of chrysanthemum seedlings. Also, Mokenny (2016) agreement with this opinion that the effect of aphid insects not only the direct

effect on flowers but also the most effect on chrysanthemum flowers through as a vector of virus "breaking" which transmitted it to chrysanthemum flowers.

2. Effect of infestation by aphid and thrips on the vascular bundles of chrysanthemum flowers:

The obtained results showed that the effect of chrysanthemum aphid *M. sanborni* and ornamental plant thrips, *F. tritci* concentrated on the vascular bundles in the tissue of the petals of chrysanthemum flowers which consider the factory of the food in the plant. The damage in theses vascular bundles increase with the high infestation by the two insects and decrease with the low infestation by them. This is show clearly from Figure (1) which showcross - sections for petals of chrysanthemum flowers and show the effect of infestation by aphid and thrips 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 chrysanthemum plant. As shown as in this figure by increase infestation with the two insects the damage in vascular bundles increase and so more bad, also morphological and physiological effects will occur due to deficient in water and important dissolved salts.

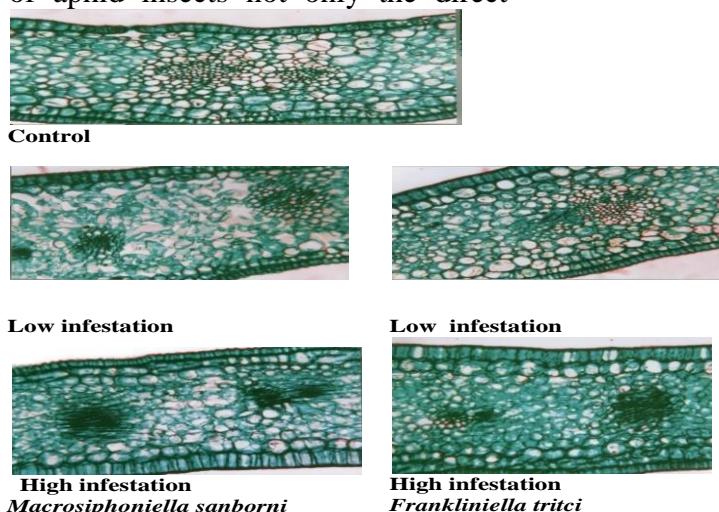


Figure (1):The damage symptoms of chrysanthemum flowers tissues (vascular bundles) after infestation by *Macrosiphoniella sanborni* and *Frankliniella tritci*.

The obtained results are agreement with those obtained by Pollard (2013) who studied the feeding penetration of *Myzus persicae* (Sulz.) (Hemiptera: Aphididae) nymphs into tulip leaf epidermis, as shown by a study of stylets and tracks, may be 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 but occurs to a limited extend during intercellular penetration due to partial rupture of the epidermal end walls, in the mesophyll the stylet path is intercellular but a few cells were penetrated by tracks.

Also, the obtained results are agreement with those obtained by Peng and Miles (2015) in Australia, detected that *M. sanborni* feeding on the chrysanthemum flowers that occurs and concentration in the parenchymal and vascular tissues of the chrysanthemum tissues. The aphids will feed on tissues and on aqueous diets containing low concn. Davidson (2014) reported that the plant exhibits many pathological features as a result of aphid attack, the food of aphids is the cell sap of plants derived from various cells of the plant tissues, especially the vascular bundles. Also, Zuniga *et al.* (2016) studied the effect of gramine on the feeding behavior of the aphids *Schizaphis graminum* (Rondani) and *Rhopalosiphum padi* (L.) (Hemiptera: Aphididae) and found that gramine found only in the vascular bundles, and it is suggested that gramine content and location may affect the feeding behavior of aphids in these plants. Kindt *et al.* (2003) studied characterization of the feeding behavior of Western flower thrips (Ornamental plant thrips) *F. occidentalis* and found that insect causes damage to plants when it is feeding, also this thrips species transmits *Tomato spotted Wilt virus* (TSWV) during styles penetration and also investigated that the penetration behavior (probing) of thrips on leaves causes more damage on vascular bundles.

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