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**Effect of the Infestation by *Myzus persicae* (Sulzer) and *Tetranychus urticae* Koch on the Internal Components of Aloe Vera Cactus, *Aloe barbadensis* (Miller)**

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**ABSTRACT**

The study was carried out to study the effect of the infestation by *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) and *Tetranychus urticae* Koch (Acari: Tetranychidae) on the internal components of *Aloe barbadensis* (Miller), the common name Aloe Vera cactus which belong to (Fam. Liliaceae). Experiments were carried out at two locations (governorates), Al-Orman garden (Giza Governorate) and The international garden (Alexandria Governorate) during season 2021.

Obtained results showed that the infestation by *M. persicae* and *T. urticae* reduced the concentration of the internal components of Aloe Vera leaves such as Vitamin A, Vitamin C, Vitamin E, Vitamin B12, Folic acid, Amino acids, Salicylic acids, Minerals, Sugars, Lignin, Saponins and Beta carotene. And obtained results showed also that the effect of the infestation by *M. persicae* was higher than the effect of the infestation by *T. urticae* compared to control (Aloe Vera plants which did not infest by any pests) at the two tested locations.

Statistical analysis showed that were highly significant differences between concentrations of the internal components of the infested Aloe Vera cactus plants with the two tested pests compared to the concentration of the same components in the control (non-infested cactus plants).

**INTRODUCTION**

The cactus plants consider one of the most important ornamental plants all over the world. The cactus plant's weight consists of about 95% of the water used during drought periods. The cactus plant's important due to its many kinds and shapes and ability to tolerate thirst and serve environmental conditions. This is in addition to the length of its life and does not require special service or maintenance, Ortega *et al.* (2015). The cactus plants are used for many purposes such as decoration and coordination; this is due to the large diversity of colors, shapes and sizes of its flowers. This is in addition to using these plants for many medical purposes due to those plants are an important source for many pharmaceutical and cosmetic industries, Griffith (2012)

*Aloe barbadensis* (Miller), Aloe Vera cactus (Fam. Liliaceae) is one of the plant species of the genus Aloe considered one of the most famous and popular medicinal plants is used in the cosmetic, pharmaceutical and food industries. Its leaves are full of a gel-like substance that contains many beneficial compounds such as vitamins, minerals, sugars and amino acids, Hamman (2016). Aloe Vera also contains various powerful antioxidant

compounds. Some of these compounds can help inhibit the growth of harmful bacteria, Josias (2008). Hu *et al.* (2011) reported that *Aloe barbadensis* (Miller), Aloe Vera has a long history of use as a topical and oral therapeutic, and the plant is the source of two products, gel and latex which are obtained from its fleshy leaves.

The Green Peach Aphid, *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) has one of the most important insects that infest cactus plants. *M. persicae* consider one of the major insect pests of cactus in Southern California and cause numerous many damages in both quantity and quality for the cactus directly by plant juice to loosen or indirectly by plant disease-transmitting John *et al.* (2009). Also, Jian and Nick (2011) in California found that the Green Peach Aphid, *M. persicae* has considered a major insect pest of many horticultural crops such as ornamental plants.

*Tetranychus urticae* Koch (Acari: Tetranychidae) consider one of the most important pests of many ornamental plants, Jaskiewicz (2012) reported that the strong infestation by *T. urticae* resulted in the deformation of stems, leaves and flowers of many ornamental plants. Also, Derek (2015) in Australia reported that *T. urticae* is a serious pest on many ornamental plants, and it feeds mainly on the young leaves and developing flower buds of these plants.

This study was carried out to study the effect of the insect infestation by *M. persicae* and *T. urticae* on the internal components of *A. barbadensis*, Aloe Vera cactus. Experiments were carried out at two locations (governorates), Al-Orman garden (Giza Governorate) and the international garden (Alexandria Governorate) during season 2021.

## MATERIALS AND METHODS

Experiments were carried out to study the effect of the infestation by *Myzus persicae* (Sulzer) and *Tetranychus urticae* Koch on the internal components of *Aloe barbadensis* (Miller), Aloe Vera (Fam. Liliaceae) cactus. Experiments were carried out at two locations (governorates), Al-Orman garden (Giza Governorate) and the international garden (Alexandria Governorate) during season 2021.

### **Experimental Design:**

Samples contained 15 trees of the tested Aloe Vera cactus in both two gardens (governorates). In each garden, we selected five trees left free of any infestation used as control, five trees infested with artificial infestation by *M. persicae* and five trees infested with artificial infestation by *T. urticae*. And these tested trees were in isolated aria at the two gardens. When the two tested pests reached to its pick (highest infestation) on these cactus plants during the period March to May, we took random simply 25 leaves from the infested trees (five leaves of each the five trees) and 25 leaves from non-infested trees to the lap at the two places. And took the means of the concentrations of the important internal components of both infested and non-infested plants.

### **Determination of the Internal Components of Aloe Vera Cactus Plants:**

#### **The Internal Components Extraction:**

The internal components were studied (Vitamin A, Vitamin C, Vitamin E, Vitamin B12, Folic acid, Amino acids, Salicylic acids, Minerals, Sugars, Lignin, Saponins and Beta carotene). These components were extracted from 0.25 kg fresh tissue of Aloe vera leaves. The tissues were ground in liquid nitrogen with a mortar and pestle. Then few mls of tris buffer extraction were added (1:2, tissue: buffer). The medium of extraction contained tris-HCL buffer (0.1mM tris, pH 7.5, 4mM B-mercaptoethanol, 0.1mM EDTA-Na<sub>2</sub>, 10mM KCl and 10mM MgCl<sub>2</sub>). The crude homogenate was centrifuged at 10.000xg for 20min. The supernatant was used for gel analysis by SDS-polyacrylamide gel electrophoresis (SDS-PAGE) according to the method of Laemmli (1970).

**Gel Preparation:**

Sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) was performed using 12.5% acrylamide and 0.8% bis-acrylamide running gel consisting of 0.375 M Tris-HCl (pH 8.8) and 0.1% SDS. Stacking gel (10 mm) was made using 4.5% acrylamide containing 0.8% bis-acrylamide in 0.125 M Tris-HCl (pH6.8) and 0.1% SDS. The electrophoresis buffer contained 0.025 M Tris-HCl, 0.19 glycine and 0.1% SDS. The samples were homogenized in 0.12M Tris-HCl (pH 6.8), 0.4 SDS, 10 B-mercaptoethanol, 0.02% bromophenol blue and 20% glycerol. The samples were then heated for 3min. in a boiling water bath before centrifugation. The gel was run under cooling at 90v for the first 15min, then 120v for the next 0.5 hr and finally 150v for the remaining 1.5hr. Sheri, *et al.* (2000).

**Electrophoresis Conditions:**

The running buffer was poured into a pre-cooled (4°C) running tank. The running buffer was added to the upper tank just before running so that the gel was completely covered. The electrodes were connected to a power supply adjusted at 100v until the bromophenol blue dye entered the resolving gel and then increased to 250v until the bromophenol blue dye reaches the bottom of the resolving gel.

**Gel Staining and Destaining:**

After the completion of the run, the gel was placed in a staining solution consisting of 1g of Coomassie Brilliant blue-R-250; 455 ml methanol; 90ml glacial acetic acid and completed to 1L with deionized distilled water. The gel was destained with 200ml destaining solution (100ml glacial acetic acid, 400ml methanol and completed to 1L by distilled water) and agitated gently on a shaker. The destaining solution was changed several times until the gel background was clear.

**Gel Analysis:**

Gels were photographed using a Bio-Rad gel documentation system. Data analysis was obtained by Bio-Rad Quantity one Software version 4.0.3, the sugar and protein were analyzed by High-Pressure Liquid Chromatography (HPLC).

**Statistical Analysis:**

In these experiments, the effect of the insect infestation by *M. persicae* and *T. urticae* on the internal components of Aloe Vera cactus 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

Experiments were carried out to study the effect of the infestation by *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) and *Tetranychus urticae* Koch (Acari: Tetranychidae) on the internal components of *Aloe barbadensis* (Miller), Aloe Vera (Fam. Liliaceae) cactus. Experiments were carried out at two locations (governorates), Al-Orman garden (Giza Governorate) and the international garden (Alexandria Governorate) during season 2021.

**Giza Governorate:**

Data obtained tabulated in Table (1) show the effect of the infestation by *M. persicae* and *T. urticae* on the internal components of Aloe Vera leaves in Al-Orman Garden (Giza Governorate) during season 2021. Data obtained showed the concentrations of Vitamin A, Vitamin C, Vitamin E, Vitamin B12, Folic acid, Amino acids, Salicylic acids, Minerals, Sugars, Lignin, Saponins and Beta carotene were 5.3, 4.2, 5.7, 4.9, 4.8, 5.3, 3.3, 7.5, 6.3, 4.5, 3.3 and 4.3 mg/g, respectively in the control plants (plants did not infest with any insect). While it was 2.9, 2.2, 3.1, 1.7, 2.1, 1.8, 1.5, 3.5, 3.7, 1.3, 0.9 and

1.5 mg/g, respectively, in the plants infested by *M. persicae* only. While the same components were 4.2, 3.4, 4.3, 2.3, 3.2, 3.5, 2.7, 4.6, 4.8, 3.3, 1.7 and 2.3 mg/g, respectively in the plants infested by *T. urticae* only.

#### Alexandria Governorate:

Data obtained tabulated in Table (1) also showed the concentrations of Vitamin A, Vitamin C, Vitamin E, Vitamin B12, Folic acid, Amino acids, Salicylic acids, Minerals, Sugars, Lignin, Saponins and Beta carotene in Alexandria Governorate were 4.9, 3.8, 4.5, 3.9, 3.7, 4.8, 2.9, 5.9, 4.3, 2.9, 1.7 and 2.6 mg/g, respectively in the control plants (plants did not infest with any insect). While it was 1.9, 1.7, 1.9, 1.5, 1.3, 2.1, 0.9, 2.6, 1.5, 0.9, 0.8 and 0.9 mg/g, respectively in the plants infested by *M. persicae* only. While the same components were 2.7, 2.1, 2.8, 2.3, 2.3, 3.0, 1.5, 3.3, 2.3, 1.3, 1.0 and 1.3 mg/g, respectively in the plants infested by *T. urticae* only.

**Table 1:** Effect of the infestation by *M. persicae* and *T. urticae* on the internal components of Aloe Vera during season 2021.

Components	Giza Governorate (mg/g)			Alexandria Governorate (mg/g)		
	<i>M. persicae</i>	<i>T. urticae</i>	Control	<i>M. persicae</i>	<i>T. urticae</i>	Control
Vitamin A	2.9 <sup>c</sup>	4.2 <sup>b</sup>	5.3 <sup>a</sup>	1.9 <sup>c</sup>	2.7 <sup>b</sup>	4.9 <sup>a</sup>
Vitamin C	2.2 <sup>c</sup>	3.4 <sup>b</sup>	4.2 <sup>a</sup>	1.7 <sup>c</sup>	2.1 <sup>b</sup>	3.8 <sup>a</sup>
Vitamin E	3.1 <sup>b</sup>	4.3 <sup>c</sup>	5.7 <sup>a</sup>	1.9 <sup>c</sup>	2.8 <sup>b</sup>	4.5 <sup>a</sup>
Vitamin B12	1.7 <sup>c</sup>	2.3 <sup>c</sup>	4.9 <sup>a</sup>	1.5 <sup>b</sup>	2.3 <sup>a</sup>	3.9 <sup>a</sup>
Folic acid	2.1 <sup>c</sup>	3.2 <sup>b</sup>	4.8 <sup>a</sup>	1.3 <sup>b</sup>	2.3 <sup>a</sup>	3.7 <sup>a</sup>
Amino acids	1.8 <sup>c</sup>	3.5 <sup>a</sup>	5.3 <sup>a</sup>	2.1 <sup>b</sup>	3.0 <sup>a</sup>	4.8 <sup>a</sup>
Salicylic acids	1.5 <sup>c</sup>	2.7 <sup>b</sup>	3.3 <sup>a</sup>	0.9 <sup>b</sup>	1.5 <sup>a</sup>	2.9 <sup>a</sup>
Minerals	3.5 <sup>c</sup>	4.6 <sup>b</sup>	7.5 <sup>a</sup>	2.6 <sup>c</sup>	3.3 <sup>b</sup>	5.9 <sup>a</sup>
Sugars	3.7 <sup>b</sup>	4.8 <sup>a</sup>	6.3 <sup>a</sup>	1.5 <sup>c</sup>	2.3 <sup>b</sup>	4.3 <sup>a</sup>
Lignin	1.3 <sup>b</sup>	3.3 <sup>a</sup>	4.5 <sup>a</sup>	0.9 <sup>c</sup>	1.3 <sup>b</sup>	2.9 <sup>a</sup>
Saponins	0.9 <sup>c</sup>	1.7 <sup>b</sup>	3.3 <sup>a</sup>	0.8 <sup>b</sup>	1.0 <sup>a</sup>	1.7 <sup>a</sup>
Beta carotene	1.5 <sup>b</sup>	2.3 <sup>a</sup>	4.3 <sup>a</sup>	0.9 <sup>b</sup>	1.3 <sup>a</sup>	2.6 <sup>a</sup>
F (0.05)	225.71			315.25		
L.S.D	1.25			1.05		

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

Statically analysis showed that were highly significant differences between the concentrations of the internal components of Aloe Vera leaves which infested by *M. persicae* and *T. urticae* compared to the concentrations of the same components of non-infested plants (control), whereas F (0.05) and L.S.D values in Giza Governorate were 225.71 and 1.25, respectively and F (0.05) and L.S.D values in Alexandria Governorate were 315.25 and 1.05, respectively.

These results were in agreement with those obtained by Gahukar (2015) who found that the 48.9% reduction in *Aloe barbadensis* (Miller), Aloe Vera plant damage refer to aphid feeding especially *M. persicae* which was a dangerous pest to this cactus species and also this feeding affecting highly on the components of the gel which found in their leaves. Ruparao (2019) referred to the effect of *M. persicae* attacking the Aloe Vera cactus that losing about 12 percent of its production and this pest causes economic injury levels (EIL) and economic threshold levels (ETL), also this pest effect on the internal components of Aloe Vera especially methanol leaf extract. Sofia *et al.* (2018) in Bulgaria found that *Tetranychus urticae* was one of the most dangerous pests which attack almost all parts of *Aloe barbadensis* (Miller), Aloe Vera cactus and causes damages to the most internal components of this plant leaves.

These results were agreement also with those obtained by Srinivasa and Ramachandra (2008) who found that the green peach aphid, *Myzus persicae* was a serious pest to *Aloe barbadensis* (Miller), Aloe Vera cactus and affected the most internal

components of cactus leaves. Also, Mary and Frederick (2006) reported that *Tetranychus urticae* causes harmful damage to *Aloe barbadensis* (Miller), Aloe Vera cactus leaves and effect on many internal components of this cactus leaves. Lastly, Jeong and Soo (2014) in Korea reported that Aloe Vera aphid, *Aloephagus myersi* Essig was a serious pest to Aloe Vera cactus and the infestation by this insect affected many important internal components of this cactus plants.

## REFERENCES

- Derek, M. (2015). The biology and main causes of changes in number of the *T. urticae* on cultivated ornamental plants in South Australia. *Australian Journal of Zoology*, 12(3): 225-230
- Gahukar, R. (2015). Evaluation of plant- derived products against pests and diseases of medicinal plants. *Crop Protection*, 31(2): 185- 197
- Griffith, M. (2012). The origins of an important cactus crop (Cactaceae). *American Journal of Botany*, 5(2): 215-219
- Hamman, J. (2016). Composition and applications analysis of *Aloe barbadensis* (Miller), Aloe Vera leaf gel. *Molecules*, 15(3): 345-358
- Hu, Y.; Xu, J. and Hu, Q. (2011). Evaluation of Antioxidant Potential of Aloe Vera, *Aloe barbadensis* (Miller) Extracts. *Journal of agricultural and food chemistry*, 51(16): 7788-7791
- Jaskiewicz, B. (2012). Observations on the occurrence on *Tetranychus urticae* on some ornamental plants. *Folia Horticulturae*, 5 (2): 15-20
- Jeong, H. and Soo, J (2014). Notes on the Aloe Vera aphid, *Aloephagus myersi* Essig (Hemiptera: Aphididae) on non-native Aloe plants in Korea. *Korean journal of applied entomology*, 53(3): 317-319
- Jian, L. and Nick, C. (2011). Current status of the green peach aphid *M. persicae*, susceptibility to conventional insecticides on ornamental plants in Southern California. *Pest Management Science*, 6(4): 525-530
- John, B.; Toscano, N. and Ballmer, G. (2009). Greenhouse and field evaluation of six novel insecticides against the green peach aphid, *Myzus persicae* on ornamental plants. *Crop protection*, 9(2): 25-30
- Josias, H. (2008). Composition and applications of *Aloe barbadensis* (Miller), Aloe Vera leaf gel. *Molecules*, 13(8): 1599-1616
- Laemmli, U. K. (1970). Cleavage of structural proteins during the assembly of the head of bacteriophage T4. *Nature*, 15(27): 680 – 685, 1970
- Mary, D. and Frederick, A. (2006). An evaluation of the biological and toxicological properties of *Aloe barbadensis* (Miller), Aloe Vera. *Journal of Environmental Science and Health Part C*, 24(1): 103-112
- Ortega, P.; Sajama, J. and Sotola, E. (2015). Diversity and conservation in the cactus family. *Desert plants*, 5(3): 157-165
- Ruparao, T. (2019). Management of pests and diseases of important tropical medicinal and aromatic plants. *Journal of applied research on medicinal and aromatic plants*, 7(4): 65-73
- SAS Institute (1988). SAS/STAT User`s Guide, Ver. 6.03. SAS Institute Inc., Cary, North Carolina.
- Sheri, L. H.; Nicolas, E. S. and Joanna, B. G. (2000). Comparison of protein expressed by *Pseudomonas aeruginosa* strains representing initial and chronic isolated from a cystic fibrosis: an analysis by 2-D gel electrophoresis and capillary liquid chromatography tandem mass spectrometry. *Microbiology*, 146: 2495-2508.

- Sofia, D.; Tomov, R. and Ivanova, S. (2018). The scale insects, (Hemiptera: Coccoidea) on the medicinal plants of Bulgaria. *Agricultural and Horticultural crops*, 11(3): 225-230
- Srinivasa, R. and Ramachandra, C. (2008). Processing of *Aloe barbadensis* (Miller), Aloe Vera leaf gel. *American Journal of Agricultural and Biological Sciences*, 3(2): 502-510

### ARABIC SUMMARY

أثر الإصابة بحشرة من الخوخ الأخضر *Myzus persicae* (Sulzer) وأكاروس العنكبوت الأحمر *Tetranychus urticae* Koch على المحتويات الداخلية لصبار ألو فيرا *Aloe Vera barbadensis* (Miller)

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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة - 12618 مصر

أجريت هذه الدراسة بغرض دراسة أثر الإصابة بكل من حشرة من الخوخ الأخضر *Myzus persicae* و أكاروس العنكبوت الأحمر *Tetranychus urticae* على المكونات الداخلية لصبار ألو فيرا *Aloe barbadensis* الدولية (محافظة الإسكندرية) خلال عام 2021

توصلت النتائج المتحصل عليها من تحليل المكونات الداخلية لنباتات صبار ألو فيرا *Aloe Vera* المصابة بكلتا الآفتين موضع الدراسة وهذه المواد هي: (فيتامين A, فيتامين C, فيتامين E, فيتامين B12, حامض الفوليك, حامض الأمينو, حامض الساليسك, الأملاح, السكريات, اللجنين, الصابونين, و بيتا كاروتين) ومقارنتها بالمحتويات الداخلية للنباتات السليمة الخالية من الإصابة بكلتا الآفتين إلى تأثير هذه المحتويات الداخلية للنباتات المصابة بالآفات موضع الدراسة وإنخفاض مستوى تركيزها بالمقارنة بالنباتات السليمة. كما إتضح من النتائج أيضا أن تأثير الإصابة بحشرة *M. persicae* كانت أعلى من تأثير الإصابة بأكاروس العنكبوت الأحمر *T. urticae* وذلك في كلا من موقعي الدراسة.

ويتضح ذلك جليا من التحليل الإحصائي الذي يتمثل في وجود فروق معنوية عالية بين تركيز تلك المحتويات الداخلية لنباتات الصبار المصابة بالآفتين محل الدراسة وتركيز تلك المحتويات في النباتات السليمة الخالية من الإصابة (control).