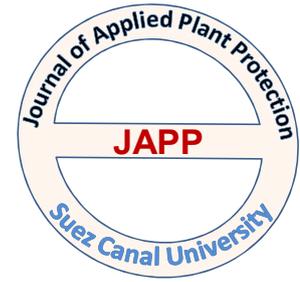




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Effect of Antioxidants on *Tetranychus urticae* (Antioxidants as a Chemical Defense on Controlling *T. urticae*)

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Abstract: The antioxidant salicylic acid, humic acid, and ascorbic acid were evaluated against two spotted spider mites *Tetranychus urticae* (Koch). Determination of total phenol content in leaves of eggplant treated with these antioxidants at different intervals was performed. The results clearly revealed that these caused reduction in mite number. Such reduction in mites were time – dependent over 28- day exposure period to reach 88 % in case of salicylic acid – treated mites whereas the percent reduction 91 % was recorded for each of ascorbic acid – and humic acid – treated mites after 28- day exposure period. A potential elevation of total phenol content was found in leaves of eggplant- treated with salicylic acid through the last 14 – day exposure. Such increases of phenol content were found to be (1.9, 13.44 and 18.7) mg/ 100 gm after 14, 21 and 28 day of treatment compared with control value to be 5.37, 10.86 and 13.44 mg/ 100 gm at parallel intervals. The percent reduction in mites could be related to the elevation of phenol content as natural defense substances.

Keywords: *Tetranychus urticae*, Antioxidants, Humic acids, Ascorbic acid, Salicylic acid, total phenol

INTRODUCTION

The two-spotted spider mite (TSSM), *Tetranychus urticae* Koch is one of the most important pests, causing yield losses to many horticultural, ornamental and agronomic crops. Defoliation, leaf burning, and even plant death can occur due to direct feeding damage. Indirect effects of feeding may include decreases in photosynthesis, transpiration (Le Goff *et al.*, 2009) a major problem in controlling *T. urticae* is the resistance to many acaricides (Puinean *et al.*, 2010) and to the hazard effect of using pesticides. So, using new method like antioxidants, using it as a chemical defense. Ascorbic acid is an essential element of plant and animal antioxidant systems, which can be defined as complex redox networks, including metabolites and enzymes (Paciolla *et al.*, 2016). Humic Acids is a main component of humic substances, which are the major soil organic constituents. Its substances are commercially products which consist of some organic molecules that originate from decomposition, microbial activity of dead biological material and plant tissues (Ekin, 2019). Salicylic acid is a plant phenolic and considered to be a hormone-like endogenous regulator, has been proposed as an endogenous signal associated with regulating oxidant levels in response to biotic stress. Recent studies have shown that its plays an important role in provoking plant resistance to various biotic and abiotic stresses (Farouk *et al.* 2008).

The aim of the present study is to clarify the effect of antioxidant on population of *Tetranychus urticae*, and to estimate the total phenol on plant.

MATERIALS AND METHODS

1. Antioxidants:

The following antioxidants were used throughout the course of this study (at concentration 0.5 %)

1.1. Humic acids:

Chemical name: Humic acid

IUPAC name: 3-nitrobicyclo [2.2.1] hept-5-ene-2,3-dicarboxylic acid

Molecular formula: C₉H₉NO₆

Molecular weight: 227.172 g/ mol.

1.2. Ascorbic acids

Chemical name: Ascorbic acids

IUPAC name: (2R)-2-[(1S)-1,2-dihydroxyethyl]-3,4-dihydroxy-2H-furan-5-one

Molecular formula: C₆H₈O₆

Molecular weight: 176.124 g/mol

1.3. Salicylic acid

Chemical name: salicylic acid

IUPAC name: 2-Hydroxybenzoic acid; 69-72-7;

O-hydroxy benzoic acid; 2-Carboxyphenol; O-Carboxyphenol

Molecular formula: C₇H₆O₃

Molecular weight: 138.122 g/ mol.

2. Maintenance of the colony of *T. urticae*:

For establishing a colony of the two spotted spider mites *Tetranychus urticae* Koch in the laboratory, the technique of (Guirguis *et al.*, 1977) was followed. The mites were collected from infested leaves of the castor bean, *Ricinus communis* trees grown at the Experimental Farm of Ismailia Agricultural Research Station, Ismailia, Egypt. One hundred adult females of *T. urticae* were transferred with a fine brush (Pelikan brush No. 000) to sweet potato leaves. Sweet potato cutting, each holding about 8 leaves, were washed under running water and then placed in tap water in 250 ml glass jar. Each jar contained three sweet potato cuttings. The colony was established with three jars. The sweet potato cuttings were changed twice a week in summer, and once a week in winter or when it was necessity. The colony was kept in cheese cloth cage (60 x 60 x 60) cm under laboratory conditions of 25±2°C; 65±5% relative humidity and 12 hrs daily illuminations by using fluorescent tubes of 40–60 watt. The colony was kept away from any pesticide contamination for six months before used in experiment.

Table (2): Value of total phenol in the leaves of eggplant after 3, 7, 14, 21 and 28 days :(mg/100g)

Chemical used	Time (days)				
	3	7	14	21	28
Control	7.25	7.80	5.37	10.86	13.44
A.A	5.27	7.80	7.64	7.35	7.46
S.A	6.5	6.03	11.9	13.44	18.7
H.A	12.05	9.65	9.57	9.36	8.49

Data in Table (3) showed that the relation between the reduction percentages and the value of the total phenol. In salicylic acid, percent reduction was (88%) with the phenol (18.7) mg/100 g after 28 days of treatment. In ascorbic acid after 28 days of treatment, the reduction percent reduction was (91%) with (7.46)

mg/100 g total phenol after 28 days of treatment. While the percent reduction was (91%) after 28 days of treatment with (8.49) mg/100 g value of phenol.

Results showed that it was relation between the percent reduction and the total phenol in leaves.

Table (3): Relations between reduction percentages of mites and value of total phenol in leaves of eggplant

Time (days)	S.A		A.A		H.A		Control
	% Reduction	Total phenol	% Reduction	Total phenol	% Reduction	Total phenol	
3	20	6.5	20	5.27	0	12.05	7.25
7	42	6.03	42	7.80	50	9.65	7.80
14	60	11.9	67	7.64	60	9.57	5.37
21	80	13.44	80	7.35	85	9.36	10.86
28	88	18.7	91	7.46	91	8.49	13.44

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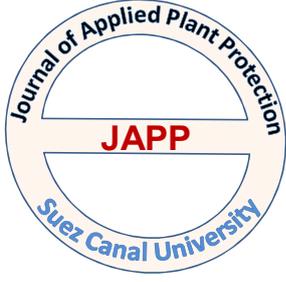
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تأثير مضادات الأكسدة علي الإصابة بالعنكبوت الأحمر ذو البقعتين (مضادات الأكسدة كمواد كيميائية دفاعية لمكافحة العنكبوت الأحمر ذو البقعتين)

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تم استخدام مضادات الأكسدة كماده دفاعية لمكافحة الإصابة بالعنكبوت الأحمر ذو البقعتين، حيث استخدم ثلاثة أنواع من مضادات الأكسدة وهم (حامض السالسيلك ، حامض الهيوميك، حامض الاسكوريك) وتم تسجيل النتائج بعد ٣، ٧، ١٤، ٢١، ٢٨ يوم من المعاملة. وقد أظهرت النتائج انه عند استخدام حامض السالسيلك أعطي نسب خفض في تعداد العنكبوت الأحمر ذو البقعتين بنسبه ٤٢% بعد ٦ أيام من المعاملة، وقد وصلت ٨٨% بعد ٢٨ يوم من المعاملة. بينما أعطت المعاملة حامض الهيوميك ٦٠% بعد ٢١ يوم من المعاملة بينما وصلت النسبة لـ ٩١% بعد ٢٨ يوم من المعاملة. وعند المعاملة بحامض الاسكوريك كانت نسبه الخفض ٦٧% بعد ١٤ يوم من المعاملة، وكانت نسبه الخفض ٩١% بعد ٢٨ يوم من المعاملة. وعند قياس نسبه الفينول في الأوراق النباتية المعاملة بمضادات الأكسدة المختلفة نجد أن في حامض السالسيلك كانت قيم الفينول في الأوراق كالاتي (٦.٥، ٦.٠٣، ١١.٩، ١٣.٤٤، ١٨.٧) ملليجرام/١٠٠ جرام بعد (٣، ٧، ١٤، ٢١، ٢٨) يوم من المعاملة، أما عند المعاملة بحامض الهيوميك فكانت قيم الفينول (٥.٠٥، ١٢.٠٥، ٩.٦٥، ٩.٥٧، ٩.٣٦، ٨.٤٩) ملليجرام /١٠٠ جرام بعد (٣، ٧، ١٤، ٢١، ٢٨) يوم من المعاملة. وعند المعاملة بحامض الاسكوريك كانت قيمه الفينول في الأوراق (٥.٢٧، ٧.٨٠، ٧.٦٤، ٧.٣٥، ٧.٤٦) ملليجرام /١٠٠ جرام بعد (٣، ٧، ١٤، ٢١، ٢٨) يوم من المعاملة.

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