Using of Some Antioxidants for Cotrolling of Mosaic Causing Viruses on Vegetables In Minia Governorate, Egypt.

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Abstract

In previous works, it has been reported that three viruses affecting some economic vegetable crops and causing severe losses in yield.These viruses, were cucumber mosaic virus (CMV), hibiscus chlortic ringspot virus (HCRSV) and potato virus Y (PVY) .The effect of aquaeous extracts of some medicinal plants on diseases caused by these viral was reported in previous paper (**Saleh *et al***., 2019*)*. This paper delt with the effect of some antioxidants in cotrolling these virus diseases. The antioxdants are ascorbic, benzoic, citric, and salycylic acids at different concentration (50, 100, and 200 ppm). Application , of some antioxidants either as soaking host seeds or spraying before inoculation have marked inhibitory effect and reduced disease infection and alleviated symmptoms particularly at older ages.

Key words: Antioxidants, CMV, HCRSV, PVY.

Introduction

Viruses are one of the most serious phytopathogens. Three mosaic viruses were used under this investigation, cucumber mosaic virus (CMV), hibiscus chlorotic ring spot virus (HCRSV) and potato virus Y (PVY). The three viruses induced mosaic symptoms and caused considerable economic losses in many vegetable and horticultural crops in Egypt and other parts of the world (**Ndungru et *al*., 2004, AoCheng *et al*, 2009, Jones and Behnek 1980, Jamal-Sabir, 2012** and **Nady -Yasmine, 2015 and Saleh *et al*., 2019).** Moreover, CMV and PVY are considered ones of the top five viruses worldwide causing diseases and severe loses in yield.

The effect of some antioxidants on the abovementioned diseases caused by the abovementioned viruses was studied to find safe and alternative method of infected plants with RNA viruses. The term antioxidants refer to the vitamins, minerals, photochemical (plant chemicals) and other natural copounds that protect from destructive radicle molecules (**Passwater *et al.*,2003)** . It has been reported that spraying susceptible tobacco plants with salyclic acid or salicylic and its dervitive such (acetyl salicylic, Aspirin) led to a significant reduction in accumulation of tobacco mosaic virus , resistant to pathogen and production of pathogen resistant (PR) in tobacco and other plants (**Antoniw and White,1980** and **Penazio *et al.*,1987**).Subsequently, **Melamy *et al*.,(1990)** found that resistant cultivars of tobacco to mosaic virus contains higher pathogen related protein than the susceptible ones. The authors added that endogenous salicylic acid was also higher in resistance cultivars than in susceptible ones. It has been reported that salicylic acid is an important component in signal transduction pathway and involved in local and systemic resistance to pathogens including virus **(Delany *et al.*,1994 and Nylor *et al.*,1998**) . It is also a key component of defense signal transduction including the full set of systemic aquired resistance and delayed symptoms development in potato infected with potato virus x (PVX). Also, symptoms produced in tobacco infected with cucumber mosaic virus were delayed (**Maleck *et al.*,2000**). In this respect, It has been repoted that ascorbic acid is an standard antioxidant (Kalaf **et *al.*, 2008**). Subsequently, **Wang *et al.*,2011** , found that ascorbic acid glutathione has a positive role in symptoms alleviation to salicylic acid –defficient plants. Recently, **Bondok and Ibrahim, (2014**) found that ascorbic and citric acids lead some physiological, biochemical and molecular aspects in tomato plants injected with tomato spoted wilt virus (TSWV). The authors added that symptoms appeared in the injected plants were delayed and reduced in severity in the treated plants with salicylic acid .Subsecquently, **Satoka *et al***., (**2016)** found that ascorbic (AS) accumulates as defense response to turnip mosaic virus resistance *Brassicae rapa* cutivars.

Salycylic acid involved in local resistant and systemic acquired resistance. It can be used against pathogen virulence, heavy stress, salt stress, toxicities of other elements. Again its application improves photopsynthesis, growth and various physiological and biochemical characteristic in stressed plants (**Antoiw and White, 1980**, **Yaplani *et al*., 1994 , Durner *e tal*., 1997, Chong *et al*., 2001, Murphy** and **Car, 2002, De Gara,2003, Shah,2003, Facilioni *et al.,2014*,Cueto-to-Ginzo *et al.*, 2016 *a and b and* Wani *et al.*, 2017*).*** Moreover**, Chong *et al.*,** (**2001**) reported Salycylic acid is a key endogenous coponents of local and systemic disease resistance in plants. The authors added that benzoic acid (BA) acts as precursor of salyclic acid biosynthesis in tobacco(*Nicotiana tabaccum cv* samsun *)* plants undergoing a hypersensitive reaction following infection with tobacco mosaic virus and led to rapid *de novo* synthesis and accumulation of conjugated benzoic acid **(Cueto-Ginzo *et al.*, 2016 a and b and Wani *et al.*, 2017**).

In recent years salicylic acid was reported to delay and alleviate symptoms development and severity such as tobacco plants challenged with PVY, sqash challenged with zucchini yellow mosaic virus (ZYMV) and peanut challenged with peanut mosaic virus(PeMV) (**Nie, 2006**, **Radwan *et al*., 2006 and Kobeasy *et al*., 2011**). More recently, it has been reported that salicylic acid mitigates physiological and prteomic changes induced by the SPCP1 strain of potato virus in tomato plants and delayed symptos expression and also reduced infection rate (**Cueto-Ginzo, *et al*.,2016 and Cueto-Ginzo *et al*., 2016 b**).

The objective of this investigation was to find an effective compounds against wide varieties of plant viruses which is not phytotoxic to plant tissues and is safe to humanbeing and animal . As a result some compounds and antioxidants are specific and effective in this respect.

Materials and methods.

Experimental work was conducted in an air conditioned, insect proof-greenhouse approximately 25 to 27 Cº. All tests plants were grown in porous clay pots containing fertile soil. Care and special precautions, including spraying with insecticides (0.2% Malathion) was taken to avoid outside infection when necessary. Moreover, touching the plants during watering or other greenhouse practices was carefully avoided.

B

Fig.2

Virus Isolation

In this study three viruses, were isolated from the farm of the Faculty of Agriculture, El-Minia University. These viruses were, cucumber mosaic virus (CMV) isolated from naturally infected arium (*Luffa aegyptiaca* cv Mill) plants showing severe mosaic. Hibiscus chlorotic ring spot virus (HCRSV) was isolated from naturally infected okra plants cv Balady (*Hibiscus esculantus.* L) showing ring spots and systemic mosaic (**Nady-Yasmine, 2015**). Potato virus Y (PVY) was isolated from pepper plants cv.Roomi (*Capsicum annuum.* L) exhibiting mosaic and deformation (**Hassan- Hanaa and Yousef, 2006**). The three viruses were propagated in appropriate hosts and used in this investigation.

Mechanical injection

The preparation of crude inoculums for each virus was achieved by crushing infected leaves in sterilized mortar , subsequently the wet bulbs were pressed through two layers of cheesecloth. The sultant infected sap was diluted when necessary. Inoculation was performed by dusting the upper surface of the leaves with 600-mesh carborundum powder, followed by gentle rubbing with a piece of cheesecloth dipped in the inoculum. Inoculated leaves were shortly washed with water after inoculation. Inoculum from arium, okra and pepper infected leaves were prepared in phosphate buffer 0.1 M pH 7 , 1 gram leaves that was ground in 5 ml buffer of each tested host. In case of single lesion transfers, the following technique described by **Basu and Giri (1992),** was employed. A single virus lesion was cut out, crushed after adding a droplet of water, on a clean microscope slide with a glass rod; the macerated local lesion was then transferred directly to a carborundum- dusted leaf by gently rubbing with the contaminated end of the rod. Except where otherwise mentioned, cucurbits were inoculated on the cotyledonary leaves, while other plants on fully expanded first true leaves.

Maintainance of the tested viruses.

The three viruses were maintained by serial injectios in young healthy plants of cucumber (*Cucumis sativum* cv Madina) for CMV, okra *(Hibiscus esculantus* cv Balady) for HCRSV and pepper (*Capsicum annum* cv Roomy) for PVY . These host plants served as the sources of viruse inocula through this study .

The all test plants were grown from seed in a mixed soil (sand: clay 1:4 v/v), and irrigated when necessary. The virus inocula was prepared as mentioned above.

Identification of viruses

Viruses were identified on basis of symptomology, host range , physiological properties and inclusion bodies (**Nady-Yasmine 2015 and Hassan-Hanna and Yousef, 2006**).

- **Effect of some antioxidants on infection with the three investigated viruses:**

This experiment was carried out at the greenhouse of the Plant pathology department,Faculty of Agriculture ,Minia University,Eypt as previously mentioned.Two treatment were used:

a) first, soaking respective seeds of respective hosts i.e.cucumber cv Madina, okra cv Balady and pepper cv Roomy in some antioxidants for 24 hours before sowing .The antioxidants used were ascorbic benzoic, citric, and salicylic acids at different concentrations (50, 100, and 200 ppm). Soaked seeds were sown in pots as previously mentioned. Three replicates were used for each treatment . Twenty days old seedlings were injected individually with respective virus, CMV in cotyledonary leaves of cucumber cv Madina , HCRSV and PVY in fully expanded leaves of okra cv Balady and pepper cv Roomy respectively.

Virus inocula for all experimental work were obtained from 27 days old seedlings and after 10 days of injection. The seedlings were ground in a sterilized mortar containing phosphate buffer 0.1 M at pH 7 (1:2 w/v). The obtained crude sap was then injcted on *Chenopodium* leaves (*Chenopodium quinoa*.Willd) by rubbing gently with cheesecloth previously dipped into the suspension of virus inocula. The leaves of healthy plants were dusted with carborundum and injected individually with the tested virus according to the method reported by (**Radwan *et al*., 2006).** Leaves of healthy plants were treated with buffer only and or sterile water and served as a control. Chenopodium(*Chenopodium quinoa*.Willd) was used in this investigation as local lesion host for the three tested viruses.

The second treatment for studying the effect of antioxidants was spraying the foliage .

Seeds of respective hosts i.e. cucumber cv Madia, okra cv Balady and peppr cv Roomy were sown in pots as previosly described . Twenty days old seedlings were inoculated with respective virus i.e. CMV, HCRS and PVY as previously mentioned. Six pots were used for each respective host for each respetive treatment as before. Seven days after inoculation plants were sprayed with antioxdants at various concentrations. Another seven days later plants were divided into two groups. First group were homogenized and their supernatant were inoculated in cheopodium and local lesion were recorded after 7days. Two controls were used , first was inoculated with water or 0.1M phosphate buffer.

Second group of seedlings received another second spray of antioxidants as above (recived two sprays) . Seven days later plants subjected to homogenization, the resultant sultants were inoculated in chenopodium and the resultant local lesion recorded after 7 days later (after 14 days).

Disease assessment:

The number of the resulting local lesions produced in chenopodium (*Chenopodium quinoa*.Willd) Were compared to that produced by the control treatment if any. The effect of the tested antioxidant was determined by using the following equation:

Relative inhibition % = A-B/A X 100 where:

A = Total number of local lesion on untreated plants (Untreated with the antioxidants, but with distilled water + virus inoculation).

B = Total number of local lesion on treated plants (Treated with the antioxidants + virus inoculation).

Inoculum for all experimental work with cucumber mosaic virus was obtained from 4 weeks old cucumber seedlings after 10 days of inoculation. The same procedures were used with okra and pepper seedling since they were inoculated with Hibiscus chlorotic ring spot virus and Potato virus Y respectively. The virus inocula were prepared by triturating 5 g of each young systemically infected cucumber leaves cv Madina, okra leaves cv Balady and pepper cv Roomy respectively in sterilized as previousely described(5 g/ 10 ml phosphate buffer OrWater). The extract was filtered through cheesecloth and supernatant were used as inocula. Four leaves of 3 test seedling plants of chenopodium (*Chenopodium quinoa* Willd) as local lesion host were treated with crude sap of systemically infected plants and inoculated with virus inocula . The green house experiments was laid in a randomized complete block design with three replicates. All exposed surface on the plants including leaves, buds, twigs, branches and fruits were sprayed with antioxidants. Control plants were sprayed with distilled water.

Results

1. Isolation, identification of the tested plant viruses, (CMV, HCRSV, and PVY).

Iisolation ,identification ,host range and inclusion bodies all perfomed in previous studies **(Hanaa-Hassan and Yousef , 2006 Nady- Yasmine, 2015).**

A- Effect of soaking seeds of cucumber cv Madina, okra cv Baalady and pepper cv Roomy in some antioxidants for 24 h before sowing on the control of dieases (as indicated by number of local lesions).

Data in Table (1) indicated that soaking cucumber seeds in ascorbic, benzoic, citric and salicylic acid at the three tested concentrations (50, 100 and 200 ppm) decreased the number of local lesion produced by CMV. The percentages of virus inhibition are shown in Table (1). In general, soaking cucumber seeds cv Madina in various antioxidant compounds at different concentrations resulted in significant reduction of local lesion and hence decreased disease incidence if compared with control treatment. Concomitant increase in concentration of antioxidants results in concomitant increase in reduction of local lesions. This is true for all tested antioxidants. Moreove,__the highest concentration of 200 ppm, salicylic, citric, ascorbic and benzoic caused the highest inhibition in lesion number 66.8, 58.8, 50.8 and 32.2, respectively. Salicylic acid at 200 ppm proved most effective in controlling CMV if compared with other tesed treatments since achived highest inhibition of local lesion.

Regaring the effec of antioxidants on disease incited by HCRSV on okra cv Balady,it behaved variably. The highest effect of antioxidants in decreasing number of local lesion and ihibition was obtained by citrc and salycylic acid , followed by ascorbic and benzoic acid however , the effect of antioxidants in decreasing number of local lesion in general was less than before with that of CMV . Intrestingy ,effect of antioxidant in cotrolling disease was less than before which may be due to mucos maerials in okra or host pathogen interaction.

The effect of antioxidants on disease caused by PVY are shown also in Table 1. In general all used concetrations decreased number of local lesion compared to control treatment and achived inhibition. The highest inhibition of local lesion was achieved by 200 ppm salicylic acid followed by citric , benzoic and ascorbic acid,16,14.7,11.5 and 10.8 repetively. Again, the effect of used antioxidants on disease caused by PVY was less than that of CMV effect in reducing disease on cucumber which may be due to type of virus ,tye of host presence sommechemical compounds(solanin) and host –pathogen interaction .

Table 1. Effect of soaking seeds of cucumber cv Madina, okra cv Balady and pepper cv Roomy in some antioxidants for 24 h before sowing on the control of diseases caused by CMV,HCRSV and PVY (as indicated by number of local lesions):

Different treatment	Conc. ppm	Cucumber cv Madina inoculated withCMV		Okra cv Balady inoculated With CRSV		Pepper CV Roomy inoulated with PVY	
		Number Of LL	% of inhibition	Number of LL	% of inhibition	Number of LL	% of inhibition
Control	0	25.0*±0.8**	0	54.3*±1.7**	54.3±1.7	40.7*±1.7**	0
Ascorbic acid	50	15.3±2.1	38.8	54.0±0.8	0.5	39.3±1.2	3.4
	100	14.7±0.5	41.2	53.3±1.2	1.8	38.3±1.7	5.8
	200	12.3±1.2	50.8	51.0±0.8	6	36.3±2.1	10.8
Benzoic acid	50	20.3±1.2	18.8	53.7±1.7	1.1	39.3±2.5	3.4
	100	18.7±0.9	25.2	52.7±1.2	2.9	38.7±2.1	4.9
	200	16.7±3.1	33.2	51.7±0.5	4.7	36.0±1.6	11.5
Citric acid	50	15.7±0.5	37.2	51.0±1.4	6	40.3±1.6	0.9
	100	13.0±0.8	48	50.7±1.2	6.6	40.0±3.3	1.7
	200	10.3±1.2	58.8	48.3±1.7	11	34.7±1.7	14.7
Salicylic acid	50	14.0±0.8	44	52.3±1.2	3.6	40.0±3.3	1.7
	100	10.3±1.2	58.8	49.3±2.6	9.2	37.0±1.6	9
	200	8.3±1.2	66.8	48.7±3.7	10.3	34.0±0.8	16

Values are means of 3 replicates, ** Reduction in number of local lesion +_ standard error
Where A= number of local lesion in control treatment B=number of local lesion inexperimental.

Effect of spraying foliage plants of cucumber cv Madina,okra cv Balady and pepper cv Roomy with some antioxidants compounds one weeks and 14days before inoculation on the control of diseases incited by CMV ,HCRSVand PVY .

Genrally spraying cucumber plants cv Madina with the tested antioxidants ascorbic, benzoic, citric and salicylic after injection produced marked and reduction in local lesions and significant inhibition in local lesion if compared with control treatment (Table, 2). Again additional spraying produced most pronounced effect in reduing number of local lesion and hence reducing number and hence controlling the diseas (Table 2).

Concomitant increase in concentrations of antioxidants resuted in decrease in number of local lesion and icrease in inhibition and cotrolling disease incidence. Salicylic acid proved superior in cotrolling diseae caused by CMV followed citric ascorbic and benzoic acid. This is quiet true particulary after the second application of antioxidants. This migt be due building up acquired resistance due plant age, accumulation antioxidants or host – pathogen interaction.

The effect of antioxidants concentraions on okra cv Balady on disease incited by HCRSV has simllar trend to that obtained previously with disease caused by CMV.

Table 2. Effect of Spraying foliage plants of cucumber CV Madina, okra CV Balady, and pepper CV Roomy with some antioxidants 7and 14 days after inoculation on the control of diseases caused by CMV, HCRSV (as indicated by number of local lesions):

Treatment	Conc. ppm	Number of LL developed on Cucumber cv Madina inoculated with CMV after				Okra cv Balady inoculated With CRSV number of LL (Days after inoculation)				Pepper CV Roomy inoulated with PVY number of LL (Days after inoculation)			
		7 D	**% of inhib.**	**14 D**	**% of inhib.**	**7 D**	**% of inhib.**	**14 D**	**%of inhib.**	**7 D**	**% of inhib.**	**14 D**	**% of inhib.**
Control	**0**	31.0*±1.6**	0.0	31.0	0.0	54.0*	0.0	54.7*	54.0	44.0 *±1.2**	0.0	44±0	0.0
Ascorbic acid	**50**	26.7±1.2	13.9	26.0±1.3	16.8	53.7±1.2**	3.7	52.0±1.6	4.4	40.7±2.5	9.1	39.3±4.2	10.7
	100	25.3±2.9	18.92	25.3±1.7	18.4	52.0±1.2	5.5	51.0±0.8	5.6	39.3±3.7	10.7	38.3±4.5	13.0
	200	24.0±2.2	22 .6	23.3±1.5	24.8	50.3±1.6	6.8	50.0±1.4	8.0	36.3±1.2	17.5	35.0±1.4	20.5
Benzoic acid	**50**	30.7±1.7	1.0	24.0±1.7	22.6	49.0±2.1	9.3	47.7±0.5	11.7	38.3±3.9	13.0	37.3±4.5	15.2
	100	26.3±3.1	15.2	24.0±1.9	226	48.0±0.8	11.1	46.7±1.2	13.5	36.7±2.4	16.6	36.3±3.7	17.5
	200	25.0±1.6	19.4	23.7±1.7	23.5	46.3±1.6	14.3	44.3±0.5	18.7	34.0±0.8	2 2.7	31.0±0.8	29.5
Citric acid	**50**	29.0±3.3	6.5	23.7±2.2	24.2	51.0±0.9	5.6	50.3±1.2	7.0	40.3±3.7	8.4	39.3±4.6	11.4
	100	27.7±2.1	10.6	23.0±1.6	25.8	49.3±0.8	8.7	48.3±1.2	10.6	40.3±4.6	9.4	38.3±4.6	13..0
	200	24.7±1.7	20.3	22.7±1.2	26.8	48.0±0.9	11.1	46.3±1.7	10.6	33.3±3.4	24.3	32.7±2.1	25.7
Salicylic acid	**50**	24.0±3.6	22 .6	16.3±3.1	47.4	47.7±1.6	11.2	45.3±1.2	16.1	39.0±2.9	11.4	38.3±3.3	13.0
	100	23.7±3.7	25.5	13.3±2.4	57.1	45.7±1.9	15.2	43.0±1.6	20.4	36.7±1.2	16.6	36.0±2.9	18.0
	200	21.7±1.2	30.0	12.3±3.9	60.0	45.0±1.2	16.3	42.3±1.2	22.2	34.0±0.8	33.8	33.3±1.2	24.2

Values *Mean of 3 replicates+_standard error.
% of vrusinhibition= A-B/A*100 A=number of local lesion in control, B=number of local lesion in experimental.

However, the effect of antioxidant concentrations was less effective in decreasing the disease than that obtained with diseases caused by CMV particulaly after the second application of antioxidants. Again this might be due to mucous materials lin okra , host-pathogen iteraction . Regarding, the effect of different concentrations of antioxidants on diseases incited by PVY they have similar trend to that obtained wih disease incited by CMV . However, the effect of different concentrations of antioxidants even after the second application of the two sprays were less than that obtained with CMV. This might due to the presence of some compunds that affect action of antioxidants such solanin dominant in solanaceae. However, salicylic ,benzoic were more effective than the remainder paticulary after the second application of antioxidants. It, seems that spraying was more effective than soaking in controlling these diseases. More experiments are required at large scale under field and climatic conditions to evaluate the effect of these antioxidants

Discussion

Vegetable crops repersent very important group of food plantations in Egypt (**Montasser,1988 and Saleh and Stead,2003**). Reportes of the Egyptian investegators have recently shown that cucumber mosaic virus (CMV), hibiscus chlorotric ring spot virus (HCRSV) and potato virus Y (PVY) are among those widly spread in local platations of vegetable causing sever losses in yield (**Megahed, *et al.*, 2012 a, Nady- Yassmine –Nady, 2015 and Saleh *et al*., 2019**). Application antioxidants including ascorbic, benzoic, citric and salycylic acids indvidually at different concentrations 50, 100 and 200 ppm as soaking treatments of seeds markedly reduced number of local lesion produced in *Chenopodium quinoa* L., and hence controlled disease incidence caused by the tested viruses (CMV, HCRSV and PVY). As far as the effect of some different types of componds on controlling virus diseases under this investigation, it has been indicated that application of some antioxidants as soaking treatment markedly reduced disease severity and alleviated symptoms . Simillar results were also shown when these antioxidants at the same concentrations were obtained when they applied as spraying after injection of the tested viruses and hence reduced disease severity and disease symptoms and alleviated symptoms produced if compared to control treatment. Moreover, concomitant increase in concentrations of antioxidants resulted in concomitant decrease in local lesion number and hence controlling the disease. This is quite true for all application of antioxidants when used either as soaking or spraying particularly with salicylic acid at 200 ppm.

The most intresting results in that further application of spraying antioxidants than once or twice before or after inoculation produced more pronounced effect in decreasing number of local lesion and hence disease incidence particularly at higher concentrations which may be attributed to plant age, host pathogen interaction, receiving the plants more antioxidants and presence of some chemical copunds in some hosts. This is ture for all the caused by the tested viruses (CMV, HCRSV and PVY) under this investigation. In this respect it has been reported that a number of different types of compounds are known to inhibit certain plant viruses *in vivo* **(Montasser, 1988).** The term antioxdants refers to the vitamins, mineral and photochemical (plant chemical and other natural compounds) that protect from destructive molecules called free radical **(Passwater, *et al.*, 2003).** The effect of some antioxidants on the abovementioned diseases caused by the abovementioned viruses was studied to find safe method of controlling plant virus diseases. In this respect , it has been repoted that ascorbic acidis is an standard antioxidants (**Kalaf *et al*., 2008).** Subsequently, **Wang *et al*., (2011)** found that ascorbic acid and glutathione have positive role in symptoms alleviation in salicylic deficient plants infected with RNA viruses. **Khan *et al* ., 2011** ,reported that ascorbic acid has important role against pathgenic attack at different sites of plant and play crucial role in resistant to pathogens.The authors added that it is also a pre cursor of salicylic acid. Subsequently, **Bondok and Ibrahim, (2014**) found that ascorbic and citric acids lead some physiological, biochemical and molecular aspects in tomato plants inoculated with tomato spotted wilt virus (TSWV). The authors also found that symptos appeared in the inoculated plants were delayed and reduced in severity in the treated plants with salicylic acid. Recently, **Satoka *et al***., (**2016)** found that ascorbic (AS) accumulates as defnce response to turnip mosaic virus resistance *Brassicae rapa* cutivars. The inhibitory action of antioxidant towards several pathogens has been reported (**Paxton,1981**) . This could be related to direct effect of the chemical substances on the pathogen or on the host , or host- pathogen interaction, or changes in the host resistance by activation in the host defense mechanism to pathogen via production of phytoalexin in response to infection. Again might be due to physiological or biochemical induction of low molecular weight phytoalexin with antimicrobial activity (**Paxton,1981,and Omyma-Awadalla,2008)** .The results obtained in this investigation on antioxdants are in a greement with those obtained by salyclic acid (it's derivitives) and other tested antioxidants on tobacco infected with TMV since they led to significant reduction and accmulation of the virus (**Antoniw and White, 1980 and Malamy and Klssing 1992))**. In this respect, **Malamy and Klessing,1992** reported that salysilic acid has important role in defens respose to pathogens, induction of acquired resistance, disease resistanc and PR protein. Again, **Mayers *et al*., 2005** found that salicylic acid induced resistant to cucumber mosaic virus in tobacco (*Nicotiana tabacum*L.). Subsequently, **Kobeasy *et al.*, (2011)** found similar results with Peanut mosaic virus (PeMV) since they found that spraying peanut cv Giza 5 with salicylic acid at 50,100and 200 ppm induced systemic resistant . Previous results by many investigators confirmed the abovementioned results, and involovement of saycylic acid in signal transduction pathway and its role in systemic resistiance to pathogens including viruses (**Delaney *et al.*,1994, Dempsey *et al*,1999, Chong *etal*., 2001, Maleck *et al.*, 2000, Murphy, 2002 and Shah, 2003**). For instances, results of wide variety of studies demonstrated that salicylic acid(SA) plays a role in many aspects of defense response (**Dempsey *et al*,1999,Chong *et al*.,2001).** These include the containment of pathogen spread, activation of cell death and the induction of local and systemic disease resistanc. Moreover, SA appears to utilize many different mechnisms to induce these responses. For example SA has been shown to alter expression activity of varios enzymes poteniate OB (oxidative burst) cell death, expression of some defense gene and possibly cause the generation of free radical. Subsequently, **Sikia *etal.*, 2003** repoted that SA enhanced growth parameters and give high protection of chickpea seedling against wilting caused *F.oxysporum f.sp ciceri* . Recently, it has been reported that spraying susceptible tomato plants cv appllo infected with tomato leaf curl virus effectively reduced the disease (**Ong and Cruz,2016).**

For instance, salicylic cid delayed symptoms development in potato infected with PVY and alleviate severity in tobacco plants challanged with PVY (**Nie, 2006**). Subsequently, **Radwan *et al.*, (2006)** stated that salicylic acid mechanism might be through antioxidant system when they used it at 10, 50 and 100 ppm to control Zucchini yellow mosaic virus on squash. It has been repoted that the promptive effect of aquaeus extracts of marigold as antiviral, antibacterial and antifungal could be due to flavonoids, patuletin, qercetagetin, carotenoid lutein, and quercetin and their derivatives which act as strong antoxidants and cytoprotectives activities (**Hook *et a.l* ,2010**).

In addition, **Wang *etal*., (2011),** found that salycylic acid involved in local and systemic acquired resistance . It can be used against pathogen virulence, heavy stress, salt stress, toxicities of other elements, its application improves photpsynthesis, growth and various physiological and biochemical characteristic in stressed plants(**Antoiw and White, 1980**, **Yaplani *etal*, 1994 , Durner etal., 1997, Chong *etal*., 2001,Murphy** and **Car,2002, De Gara,2003, Shah,2003, Facilioni *etal.*, 20014, Cueto-Ginzo *etal*.,2016 and Wani *eta*l.,2017) .**

Recntly, the results obtained in this investigation also were confirmed by **Facilioni *et al.*, (2014)** since they found that salicylic acid is an inducer of systemic aquired resisance and could be a potential candidate in control of plant viral diseases . Also they added that application of salicylic acid in challenged potato with virus X improved physiological parameters (gas exchange, chlorophyll content), reduced virus accumulation , induction of pathogenic -relateded protein and tolerance of infected plants. Subseqently, it has been reported that application of exogenous salicylic acid delays infection and counteracts alterations induced by dwarf mosaic virus in maize proteome and mitigates physiological and proteomic changes induced by the SPCP 1 strain of potato virus X in tomato plants s**(Cueto- Ginzo *etal*.,2016A and Cueto- Ginzo *etal*.,2016 B**) .**On the** other hand ,it has been found effect of some antioxidants on decreas disease severity caused HCRSV and PVY both okra cv Balady and pepper cv Roomy less effective than CMV cucumber cv Madina . This may be due mucous compounds in okra ,types of host , types of virus ,host –pathogen interaction and solanin compound present in solanaceae (**Jones *et.al,* 1980 , Falcionin, *e t al*. 2014, Bhyan *et al*, 2007**

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استخدام بعض مضادات ألأكسده في مقاومة فيروسات المسببة لأمراض التبرقش على بعض محاصيل الخضر فى محافظة المنيا – مصر.

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قسم أمراض النبات –كلية الزراعة –المنيا –مصر

تم اجراء هذه الدراسة فى معامل قسم امراض النبات وصوبة ومزرعة امراض النبات بكلية الزراعة– جامعة المنيا.

حيث أدى نقع بذور النباتات العائلة للفيروسات والمسببه لأمراض التبرقش وهي موزايك الخياروفيروس البقعةالحلقية في الهبسكس(وتم عزله تحت ظروف الدراسه من الباميه) وفيروس البطاطس Y فى محاليل مضادات الأكسدة وهي حامض الأسكوربيك والبنزويك والستريك والساليسليك بتركيزات مختلفة(50و100و200 جزء في المليون)لمدة 24 ساعة ثم زراعتها وحقنها بالفيروسات الممرضه اوضحت النتائج أن دلك ادى الى خفض نسبة الإصابة بالفيروسات بدرجة ملحوظة و عند رش النباتات المحقونة بالفيروس والمنقوعة في مضادات ألأكسده ورشها فيما بعد بمضادات الأكسدة ادى ذلك أيضا الى خفض الإصابة بدرجة أكبر.

أدى استخدام مضادات الأكسدة المذكورة كنقع ورش للنباتات بعد وقبل الحقن ادى ذلك الى تحسن ملحوظ فى انخفاض نسبة الإصابة و كان حامض السالسليك اكثر مضادات الأكسدة تاثيرا خاصة فى التركيزات العالية فى الاعمار المتقدمة