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Evaluation of the efficiency of hydrogen peroxide against *Fusarium oxysporum*, which causes fusarium wilt on tomato plant

Mena waleed Hatem*

Department of protection, college of Agriculture / University of Baghdad, Baghdad, Iraq.

* Corresponding author: Mena waleed Hatem; e-mail: majeedhameedn@gmail.com

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ABSTRACT

This study aimed to assess the efficiency (hydrogen peroxide) to resist wilt plants tomato caused by pathogenic fungus *Fusarium oxysporuim* under laboratory protected and field and home conditions**.** The results of the effect of treatment hydrogen peroxide on the growth of pathogenic fungus *F. oxysporum* under laboratory conditions that all concentrations tested may decline significantly linear growth and dry weight of the biomass of the fungus pathogen rate and the number of spores have treatment surpassed 200 ppm of hydrogen peroxide significantly on the other to reduce the rate of growth linear and dry weight of the biomass and the number of spores where he recorded 26.0 mm, 0.0 mg, 10 x 0.46 6 / cm 2, compared with the control treatment (0.0 ppm of hydrogen peroxide which recorded 45.67 mm, 0.33 mg, 10x 9.17 6 Spore / cm^2, respectively. the results also showed that the treatment of 200 ppm of hydrogen peroxide has achieved the highest percentage inhibition of the growth of the dry weight of biomass which recorded 43.06% and 100%, respectively. results of the effect of three concentrations of hydrogen peroxide (50 ,100 ,200) ppm on some tomato plant growth standards under protected cultivation and field conditions that all treatments have improved significantly, "most studied growth standards compared with two treatment, control and pathogen treatment in addition to the reduced significantly of the percentage of wilting plant.

Keywords: *Fusarium oxysporuim* sp., hydrogen peroxide, tomato, pathogenic, biomass.

1. INTRODUCTION

The tomato (*Solanum lycopersicon* L) is one of the most important vegetable crops in the world in general and in Iraq in particular. This crop is grown mainly in the fields and in greenhouses in all countries of the world. This crop is exposed to infection with many fungal pathogens, the most important fungus *Fusarium oxysporuim* f.sp. lycopersicon which infects tomato plants, causing vascular wilt where infects the roots during all phases of plant growth, causing a considerable material losses disease (8,3). The excessive use of pesticides chemical to control the disease in addition to health and environmental harmful pesticides effects on humans and other living organisms as well as the relatively high prices of these pesticides, all of these reasons raised specialists to search for alternatives to these chemicals (2) where the attention of researchers to use other mechanisms of plant disease resistance (12,1). That one of the mechanisms that have been used to control this disease is to use chemical stimuli and these stimuli is hydrogen peroxide, where you play these catalysts play an important role in stimulating the plant's resistance to several fungal diseases, including fungus *Fusarinm oxysporum*. Use hydrogen peroxide to successfully combat certain plant diseases such as wilting tomato plants disease (11,1), chickpeas (12) and disease rot roots and stalks cucumber caused by pathogenic fungus *Fusarium oxysporum* f. Sp. Radices cucumerinum (13), and blight anchored in wheat caused by a fungus pathogen *Fusarium graminearum* (5). As indicated by some sources to the role of hydrogen peroxide in the fight against some fungal diseases have showed (1) that

these stimuli reduced the severity of the infection tomato plant vascular wilt disease caused by pathogenic fungus *Fusarinm oxysporum*. Therefore, this study aimed to determine the effective concentration of hydrogen peroxide in the inhibition of the growth of pathogenic fungus *Fusarinm oxysporum* under laboratory conditions as well as to study the effect of these stimuli on plant growth and plant health standards under the Protected and field house conditions.

2. MATERIALS AND METHODS

Chemical stimuli: This study used a chemical catalyst for hydrogen peroxide (produced by the English company GCC) are the three concentrations (50ppm, 100ppm, 200ppm) to study the impact on the growth of pathogenic fungus *Fusarium oxysporum* under laboratory conditions.

2.1 The effect of hydrogen peroxide on the linear growth of the fungus pathogen *Fusarium oxysporum*

Used flasks 250 ml containing 100 ml of the culture mediaPDA and after sterilization center and cooled to score 50-40 temperature ° C added the catalyst chemotherapy at three different concentrations (50ppm, 100ppm, 200ppm) to each flask separately and then was poured in Petri dishes glass diameter of 10 cm and at a rate of 20 ml / dish and after the center-hardening Vaccinate the center of each dish disk and one diameter of 0.5 cm from pure plantation aged 7 days of the fungus *F. oxysporum* developing the culture mediaPDA. Incubated dishes on the degree of 25 ± 2 °C, and then the Diameteral growth of the various treatments rate is calculated and compared the results with the comparison treatment, where the catalyst is replaced by a chemical sterile distilled water.

The effect of hydrogen peroxide on the dry weight of the biomass of the fungus pathogen *Fusarium oxysporum*: take one tablet diameter of 0.5 cm of pure farm fungus *F. oxysporum* age of 7 days and added to a glass beaker 250 ml contains 100 ml of the culture media PDA, and after sterilization center was added stimuli three concentrations (50ppm, 100ppm, 200ppm) and after 7 days of incubation on the degree of 25 ± 2 ° of the culture mediafiltration through Wattman no filter leave . 1 biomass drying on the degree of 80 ° C for 24 hours, has been taking dry weight of the biomass of the fungus pathogen and the results were compared with a control treatment where he has been replaced by chemical stimuli sterile distilled water.

2.2 The effect of hydrogen peroxide on the composition of spores of the fungus *Fusarium oxysporum* pathogen rate

Having been the Diameteral growth of the various treatments rate is calculated in the solid culture media, taking one tablet of each central Zirie (diameter 0.5 cm) from each treatment was added to the tube test contains 9 ml of distilled water, shaking the pipe well "and leave for one hour and then calculate the number of spores of *Fusarium oxysporum* using spores counting Haemocytometer slice was taking three readings for each treatment rate.

The effect of hydrogen peroxide in the fight against wilt disease caused by a fungus, *Fusarium oxysporum* on tomato seedlings under greenhouse conditions. Carried out two trials in greenhouse return to the Department of biological control of plant / Circle Research 1 agricultural diseases, according to complete random design (CRD), where fitted plastic pots capacity of 1 kg container soil sterile, the seeds were planted tomato Local class treatment of three concentrations of hydrogen peroxide are (50ppm , 100ppm, 200ppm) separately and at a rate of 10 seeds / pot, and after 5 days were treated pots vaccine pathogenic fungus *F. oxysporum* and by 100 ml of filtrate innate containing the 1 × 106 Spore / ml of the filtrate and mildew, put pots in the greenhouse was watering the soil as needed to maintain an appropriate level of moisture to ensure the vitality of the pathogen fungus according to the following treatment:

1. control treatment (without adding pathogenic fungus *F. oxysporum*).
2. Treatment pathogen alone (*F. oxysporum*).
3. Treatment conc. 50ppm of the chemical catalyst.
4. Treatment conc. 100ppm of chemical catalyst
5. Treatment conc. 200ppm of chemical catalyst
6. treatment conc.ing 50ppm of the chemical catalyst + pathogen.
7. treatment conc.ing 100ppm of chemical catalyst + pathogen.
8. treatment conc.ing 200ppm of chemical catalyst + pathogen.
9. After a period of 30 days from the seed germination of plant growth was in addition to the criteria for calculating the percentage of wilting plant account.

2.3 The effect of tomato seedlings treated with chemical catalysts on tomato plants in response

The effect of the treatment of tomato seedlings chemical catalysts on tomato plants in response to wilt disease caused by a fungus, *Fusarium oxysporum* under field conditions. Initiatives taken in lengths of 10 cm almost "sound of tomato plants where Murawab seedling roots and dive concentrations (50ppm, 100ppm, 200ppm) of hydrogen peroxide for 6 hours and then re-planting of seedlings in the soil of a field within the Agricultural college\Gaderia / Baghdad and distributed treatmants by randomized design sectors full of randomization (RBCD) At the end of the experiment it has been taking various growth standards in addition to the account percentage of the disease according to the same treatments mentioned in the greenhouse experiment.

Table 1: Effect of hydrogen peroxide treatment on the growth of F.oxysporum pathogen under laboratory conditions.

Treatment	linear growth averge \ ml	**%** wilt	dry weight biomass mg \	**%** wilt	**Spore NO. $\times 10^6 cm^2$**
0.0ppm of H_2O_2	45.67	0.0	0.33	0.0	9.17
50ppm of H_2O_2	40.0	12.40	0.31	6.06	4.61
100ppm of H_2O_2	29.67	35.03	0.24	27.27	1.65
200ppm of H_2O_2	26.0	43.06	0.0	100.0	0.46
LSD(p=0.05)	4.17	-	0.014	-	0.64

Table 2: Effect of hydrogen peroxide treatment on some growth parameters of F.oxysporum fungi under protected house conditions.

Treatment	**High plant cm**	**root length cm^2**	**leave NO.\PLANT**	**Flower NO.\PLANT**	**Fresh weight for plant g\plant**	**dry weight for plant g\plant**	% **wilt**
the control	39.40	14.56	14.60	10.50	39.17	71.07	1.27
Pathogen Treatment	12.53	6.80	6.07	2.03	10.87	4.10	76.17
Treatment of seeds	42.60	17.56	16.10	12.43	45.33	15.37	-
Seedling treatment	43.93	18.56	23.04	16.27	48.63	20.30	-
Seed + Seedling	45.83	20.20	27.10	17.27	50.43	24.13	-
Seed + Pathogen	40.77	15.40	15.0	12.53	42.77	15.87	48.53
Seedling + Pathogen	41.70	17.13	17.43	13.60	45.43	18.70	34.87
Seed + seedling + Pathogen	42.20	7.70	17.67	14.70	48.17	20.57	25.53
LSD (p=0.05)	1.20	0.83	1.28	1.38	1.82	1.10	2.11

3. RESULTS AND DISCUSSION

The results of the effect of treatment of hydrogen peroxide on the growth of pathogenic fungus F. oxysporum under field conditions that all concentrations tested significantly inhibited linear growth and dry weight biomass rate and the number of spores of the fungus pathogen (Table 1). The treatment outperformed 200 ppm of hydrogen peroxide significantly the rest of the treatment to reduce linear growth and dry weight biomass rate and the number of spores where he recorded 26.0 mm, 0.0 mg, 0.46 $*10^6$ Spore / cm^2 compared with treatment 0.0 ppm of hydrogen peroxide which recorded 45.67 mm, 0.33 mg, $9.17*10^6$ Spore / cm^2 , respectively. The results also showed that the treatment of 200 ppm hydrogen peroxide have achieved the highest percentage growth inhibition of dry weight biomass recorded as 43.06% and 100%, respectively. The results also showed that three concentrations effect of the hydrogen peroxide (50,100,200) ppm on some plants tomato growth standards under protected cultivation conditions that all treatments have significantly improved the most studied growth standards compared with the poth treatments control and pathogen, it has increase treatment (seeds + seedling) was significantly increase (plant height, root length, number of leaves and flowers / plant, fresh and dry weight / plant) and weight that recorded 45.83 cm, 20.20 cm, 27.10 leave / leaf, 17:27 flower / plant, 50.43 g / plant, 24.13 g / plant compared to the control treatment which has achieved 39.40 cm, 14.56 cm, 14.60 leave/ plant , 10.50 leaf \flower / plant, 39.17 g / plant, 13.07 g / plant respectively. The results indicate that the treatment of seeds + seedling + pathogen has surpassed my leave (seeds + pathogen) and (seedling + causal) where 42.20 achieved cm 17.70 cm, 17.67 leaf / plant, 14.70 flower / plant, 48.17 g / plant, 20.57 g / plant compared with poth treatments (seeds + pathogen) and (seedling + pathogen) that have achieved (40.77, 41.70) cm, (15.40, 17.13) cm, (15.0, 17.43) and leaf / plant, (12.53, 13.60) flower / plant, (42.77, 45.43) g / plant, 15.87), 18.70) g / plant respectively table (2).

As indicated results table (2) it surpassed the seed treatment + seedling + pathogen significantly in reducing the percentage of wilting plant where recorded 25.53% in comparison with the treatment of pathogen which has achieved 76.17% and respectively. The results of the experiment field showed that hydrogen peroxide significant effect in increasing the most plant growth standards in reducing the percentage of wilting plant has surpassed seed treatment + seedling + pathogen significantly to treat pathogen in improving the studied plant growth standards (plant height, root length, number of branches / plant and the number of fruits / plant,

average fruit weight, fresh weight and dry weight of the plant) where he recorded 56.87 cm, 25.20 cm, 1.83 branch / plant 10.33 fruit / plant, 53.13 g / plant, 162.83 g / plant, 72.23 g / plant compared with the treatment pathogen which has achieved 18.60 cm, 10.60 cm, 0.0 branch / plant, 0.0 fruit / plant, 0.0 g / plant, 67.87 g / plant, 25.67 g / plant respectively, also surpassed seed treatment + seedling + pathogen significantly in reducing the percentage of wilting plant where he recorded a 33.83% compared with 71.53% for the treatment of pathogen table (3).

Table 3: Effect of hydrogen peroxide treatment on some parameters for tomato growth of *F.oxysporum* fungi under field conditions.

Treatment	Plant height cm\	Length Root \cm	Number of branches /Plant	Number of fruits / plant	Average weight of fruits	Fresh weight g\plant	dry weight g\plant	% wilt
the control	52.53	21.10	1.36	7.13	43.17	144.47	16.73	1.23
Pathogen Treatment	18.60	10.60	0.0	0.0	0.0	67.87	25.67	71.53
Treatment of seeds	53.83	23.20	1.76	8.40	46.20	260.80	86.97	-
Seedling treatment	57.30	25.80	1.83	12.33	66.13	282.47	111.67	-
Seed + Seedling	60.27	28.83	2.13	19.90	68.57	355.33	149.73	-
Seed + Pathogen	51.37	21.57	1.46	7.23	41.27	125.67	52.20	56.63
Seedling + Pathogen	53.70	23.47	1.66	8.13	51.80	139.83	42.97	41.20
Seed + seedling + Pathogen	56.87	25.20						
LSD (p=0.05)								

He also noted (Bahn and Nandi) (10) that the Salicylic acid activates the defensive response of the plant through the genes related to pathogenecity gene expression leading to increased plant resistance to pathogens. On the other hand, according to findings of the study that triggers chemical studied it has positive effects on plant growth and winning Yield (and the amount of fruit plants elastic under-protected and field house conditions, these increases in growth and the amount of production is the result of the participation of stimuli in the physiological processes of the plant, such as taking the ions and cell elongation and sections of the cell Add to events enzyme and protein synthesis(4,6) are considered some of the stimuli chemical internal as organizations grow in nature phenolics, which affect a range of different processes of plants, which include seed germination (4) took the ions and transfer the permeability of the membrane osmotic and installation photosynthesis and growth rate (8).

4. CONCLUSION

The study concludes that the treatment of 200 ppm hydrogen peroxide has been shown to reduce the growth rate and dry weight of the biomass and the number of spores. This proved that the treatment of seed + seedling + causative had surpassed the rest of the treatment individually. It was also concluded that hydrogen peroxide had a significant effect on plant wilting. The use of hydrogen peroxide was also derived.

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