Control Fig Mosaic Virus By plant extracts with salicylic acid

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Abstract

Many attempts have been made to reduce or limit the economic damage caused by the fig mosaic virus to the growth of fig trees and their production from the fruits, in this study the disease in fig seedlings was controlled by aqueous extracts of licorice roots and garlic cloves, salicylic acid. experiments in the greenhouse showed that salicylic acid spraying treatments and aqueous extracts of licorice root and garlic plant cloves individually and twice on intact fig seedlings infected with the fig mosaic virus had a significant effect in reducing the severity of the virus and increasing plant growth indicators such as number of leaves, plant height, leaf content of chlorophyll and elements Nitrogen and phosphorous, and the interaction treatment between licorice extract and garlic cloves extract outperformed in achieving the lowest rate of infection severity, which reached 26.45%, compared to the control treatment, which amounted to 90.36%.

Keywords: Fig Mosaic Virus; Plant Extracts; aqueous extracts of licorice root ; aqueous extracts of garlic plant cloves ;Salicylic Acid.

1. Introduction

Many plants and their products have been used to combat pathogens due to the secondary compounds that these plants contain, which play an important physiological role in the plant. In addition, strains of the pathogen rarely appear resistant to the natural pesticide (Bettole et al., 1976) The inhibitory effect of the extracts on plant viruses is attributed to the presence of phenolic compounds and tannins in plant extracts, as well as alkaloids, coumarins and anthocyanins. (Walkey et al., 1991) Salicylic acid is one of the phenolic compounds that contain an aromatic ring with the hydroxyl group or its derivatives that are found in plants. (Muthulakshimi and Lingakunar , 2017) Its chemical formula C2H4(OH) COOH (Hayat et al., 2010). It is classified from plant hormones and works to regulate many physiological processes such as ion absorption, hormonal balance, stomatal movement or gas exchange. (Saklaabutdinova et al., 2003) The aqueous extract of the licorice plant
contains Glycyrrhizin acid and Glabridin (Tian et al., 2008). Glycyrrhizin with its acid is the most important two components in licorice and has similar efficacy to hormones, meaning that it is a form of plant hormones and thus leads to an increase in the formation of proteins in the plant, which raises plant growth rates (Tyler, 1993). Allicin is the main active chemical found in garlic extract, although the biological effect of garlic is attributed to sulfur-containing compounds that contain sulfur and interest in this plant extract returns to the ease of penetration of cellular membranes, the diversity of the pattern of action, and the multiplicity of intracellular targets, which each active molecule targets in the extract, there are two active ingredients of garlic: Diallyl disulphide and Allyl alcohol, which are among the strongest compounds responsible for microbial inhibition (Lemar et al., 2005).

2. Materials and methods

Place of experiments

The experiments were conducted in a nursery in Najaf Governorate in Iraq and under greenhouse conditions, during the 2020 agricultural season.

Preparation of experiments soil

The cultivation soil was prepared by plowing the soil and designed using the Randomized Complete Block Design, after which the drip irrigation system was installed, and the fig pens were made of black figs Varietie and reached 30 cm in length from the fig trees infected by fig mosaic virus and uninfected trees.

Make water extracts

The aqueous extract of the roots of the licorice plant has been prepared. With a weight of 10 gm of licorice root powder after drying and grinding it well, then adding it to 50 ml of distilled water at a temperature of 90-100 °C for a period of 3 minutes, then cooled and filtered by a piece of gauze, Then through filter paper to obtain the active ingredients. For the extract, the extract was withdrawn by a Sterile Syringe Filter and then kept in the refrigerator at 4 °C until use (Al-Ajili, 2005). While the aqueous extract of the garlic plant cloves was prepared by weighing 50 grams of fresh garlic cloves and crushed by a hand crushing machine, then 100 ml of distilled water was added to the sample and left at laboratory temperature for 6 hours, after which the product was filtered by a piece of gauze and filter paper and then transferred to a water bath at a temperature of 80 °C for an hour in order to get rid of the excess water in the filtrate by evaporation, withdraw the filtrate by a sterile Syringe filter, and then store the extract in a sealed and sterile flask in the refrigerator at a temperature of 4 °C until use (Al-Degwi, 1996).
**Preparation of the aqueous solution of salicylic acid**

The aqueous solution of salicylic acid was prepared at a concentration of 1% by adding one gram of pure acid powder to a clean, sterile glass beaker containing 100 ml of distilled water with constant stirring until completely dissolved (Ryu et al., 2004) and tightly closed the beaker and put in the refrigerator at a temperature of 4 °C until use.

Efficacy of spraying salicylic acid and aqueous extracts

This experiment was carried out on the date of 4-3-2020, and applied to seedlings of vegetative growth stage 5 to 7 leaves per seedling and its results were taken after 28 days of treatment and included 14 treatments, as follows:

treatment by licorice extract to infested seedling, treatment by garlic cloves extract to infested seedling, treatment by salicylic solution to infested seedling, treatment by licorice extract and treatment by garlic cloves extract to infested seedling, treatment by licorice extract and treatment by salicylic solution to infested seedling, treatment by garlic cloves extract and treatment by salicylic solution to infested seedling, treatment by licorice extract to uninfested seedling, treatment by garlic cloves extract to uninfested seedling, treatment by salicylic solution to uninfested seedling, treatment by licorice extract and treatment by garlic cloves extract to uninfested seedling, treatment by licorice extract and treatment by salicylic solution to uninfested seedling, treatment by garlic cloves extract and treatment by salicylic solution to uninfected seedling, treatment infected comparison, treatment uninfected comparison.

**Calculation of the severity of Fig Mosaic Virus infection on the leaves of the experiment plants**

A scale was designed based on the degrees of disease symptoms appearing on the leaves of the experiment plants, where the degrees and scale designed in this study were as follows[0 = healthy leaf, 1 = slight yellowing on the leaves, 2 = slight yellowing with light mosaic on the leaves, 3 = medium yellowing with medium mosaic on the leaves, 4 = intense yellowing with intense mosaic on the leaves, 5 = severe yellowing with severe mosaic, deformation and reduction of the area of leaves] . Then, McInnery’s equation (1923) was applied to calculate injury severity on the experiment parameters:

\[
\% \text{ the severity of the injury} = \frac{\text{total (the number of papers in each grade} \times \text{its grade}}{\text{the total number of papers} \times \text{the highest score for the scale}} \times 100.
\]

**Measuring growth indicators for experiments**
The plant growth indicators included measuring plant height, calculating the number of plant leaves, measuring the total chlorophyll content in plant leaves, in addition to measuring the content of plant leaves in terms of nitrogen and phosphorous elements.

**Statistical analysis of the data**

The results were analyzed according to the LSD test at a probability level of 5% to compare the results and Genstat program with Microsoft Excel were used to analyze the data.

**Results**

Spraying salicylic acid, aqueous extract of licorice roots, and aqueous extract of garlic cloves for resistance to fig mosaic virus on fig seedlings of the black variety.

The treatments of salicylic acid spraying and aqueous extracts of licorice root and garlic cloves on fig seedlings infected with the fig mosaic virus showed a significant effect in reducing the severity of the virus infection, and it was clear from the results that the interaction treatment between licorice extract and garlic cloves extract achieved a higher reduction in the severity of the virus infection. It reached 26.45%, followed by the interaction treatment between garlic cloves extract and salicylic acid, which amounted to 37.43%, compared to the control treatment, which amounted to 90.36%. The treatment of salicylic acid spraying and aqueous extracts of licorice and garlic plant cloves on healthy fig seedlings infected with the virus showed a significant effect in increasing plant growth indicators such as number of leaves, plant height and leaf content of chlorophyll, nitrogen and phosphorous elements. Garlic plant for healthy and infected seedlings significantly over the rest of the experimental treatments, as it achieved the highest average number of leaves in infected seedlings, reaching 14.67 leaves / plant, compared to the control treatment, which amounted to 7.36 leaves / plant. In healthy seedlings, it reached 21.44 leaves / plant compared to the control treatment, which amounted to 9.49 leaves / plant, and the highest rate of plant height reached 27.57 cm compared to 17.42 cm, and the percentage of leaf chlorophyll was 65.30 mg / 100 g⁻¹ soft weight compared to Which amounted to 50.30 mg / 100 g⁻¹ soft weight and in the amount of nitrogen and phosphorus in leaves which amounted to 14.42 mg / kg⁻¹ dry weight and 27.37 mg / kg⁻¹ dry weight respectively, as compared to 2.89 mg / kg⁻¹ dry weight and 8.35 mg / kg⁻¹ Dry weight, respectively, for the infected seedlings. As for healthy seedling treatments, the plant height was 35.43 cm and the leaf chlorophyll reached 77.42 mg / 100 g⁻¹. Soft weight and The amounts of nitrogen and phosphorous were 26.44 mg / kg⁻¹ dry weight and 36.4 mg / kg⁻¹ dry weight, respectively, compared to the comparison factors of 19.56 cm and 53.36 mg / 100 g⁻¹ soft weight and 5.74 mg / kg⁻¹ dry weight and 12.51 mg / kg⁻¹ dry weight, respectively , Which indicates
that all treatments worked to reduce the damage and severity of FMV infection in addition to improving plant growth indicators, Table (1).

| Phosphorus Mg / kg⁻¹ dry weight | Nitrogen Mg / kg⁻¹ dry weight | Chlorophyll Mg / 100 gm⁻¹ vegetable weight | Plant height (cm) | The number of plant leaves (leaf/Plant) | % The severity of the injury | Adjectives |
|---------------------------------|------------------------------|--------------------------------------------|-------------------|----------------------------------------|-----------------------------|-------------|
| 18.79                           | 8.93                         | 55.44                                      | 71.6              | 10.44                                  | 62.36                       | Infected(su) |
| 20.36                           | 9.75                         | 57.61                                      | 21.25             | 11.50                                  | 48.44                       | Infected(th) |
| 16.48                           | 8.37                         | 53.19                                      | 20.46             | 10.17                                  | 59.48                       | Infected(s) |
| 27.37                           | 14.42                        | 65.30                                      | 27.57             | 14.67                                  | 26.45                       | Infected (su+th) |
| 21.39                           | 10.29                        | 59.57                                      | 23.64             | 12.42                                  | 40.34                       | Infected (su+s) |
| 25.47                           | 10.6                         | 62.67                                      | 25.65             | 12.57                                  | 37.43                       | Infected (th+s) |
| 8.35                            | 2.89                         | 50.30                                      | 17.42             | 7.36                                   | 90.36                       | Infected |
| 28.45                           | 19.82                        | 69.29                                      | 30.39             | 16.27                                  | 0                           | uninfected su |
| 30.36                           | 30.43                        | 70.41                                      | 51.50             | 17.02                                  | 0                           | uninfected th |
| 24.01                           | 24.33                        | 50.24                                      | 60.33             | 24.74                                  | 0                           | uninfected (su) |
| 30.36                           | 30.43                        | 70.41                                      | 51.50             | 17.02                                  | 0                           | uninfected (th) |
|                                |                              |                                            |                   |                                        |                             |             |

Table 1: Efficacy of salicylic acid spraying, aqueous extract of licorice root, aqueous extract of garlic cloves and their dual combinations for controlling fig mosaic virus in fig seedlings. (su)= Aqueous extract of licorice root, (th)= Aqueous extract of garlic cloves, (s)= Salicylic acid.

3. Discussion

The results of this study agreed with the results of previous studies, which indicated that spraying salicylic acid and water extracts from licorice plant and garlic cloves plant helps to improve plant growth indicators such as plant height, leaf chlorophyll percentage, nitrogen and phosphorous elements, and this is in agreement with what many researchers have indicated like Singh (2008) Garlic cloves contain volatile oils, starch, albumin, sugar, vitamins A, B1 and B2, soaps, alkaloids, glycosides and terpenes (Saad al., 1988) (Al-hajjar, 2005) and the aqueous extract of garlic cloves has an effective inhibitory effect on plant viruses (Othman et al., 1991). The results of the amino acid analysis indicated that the aqueous extract of licorice contains the amino acids: Aspartic acid, Glutamic acid, Serine, Therionine, Tyrosine, Cystine, Methionine, Phenylalanine, Isoleucine and Lysine and the chemical detection of the aqueous extract of licorice showed that it contained all the active compounds, which included alkaloids, flavones, tannins, saponins, resins, glycosides, phenols, and it has a high inhibitory effect against plant viruses (Abdal majeed, 2018) (Al bayati et al., 2017) Salicylic acid is important in controlling growth inhibiting processes and the synthesis of ethylene and abscisic acid, as well as accelerating the formation of
chlorophyll and carotene pigments, accelerating the process of photosynthesis and increasing the activity of some important plant enzymes and in addition to its role in increasing the level of plant hormones such as oxins and cytokines that affect the processes of cell division and elongation (Joslyn, 1970) (Shahin et al., 2010) that salicylic acid works to eliminate viral infection and has high efficiency in stopping the multiplication of plant viruses (Uquillas et al., 2004).

4. Conclusion

The study showed that spraying salicylic acid and aqueous extracts made from the roots of the licorice plant and the lobes of the garlic plant are of great importance in improving the growth of fig plants and treating the symptoms of the fig mosaic virus, Therefore, it can be used in form of pesticides natural and non-polluting with ease of manufacture to reduce the economic damage caused by this virus

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