

زانكۆى سەلاحەدىن - ھەولىر Salahaddin University-Erbil

## Antimicrobial Activity of Selected Plant Extracts Against Specific Tomato Plant Pathogens

A Dissertation

Submitted to the Council of the College of Agricultural Engineering Sciences at Salahaddin University-Erbil in Partial Fulfillment of the Requirements for the Degree of Doctorate of Philosophy (PhD) in Microbiology

## By

## Kamalaldeen Mohammad Fatah Hawrami

B.Sc. Biology- Mosul University- 1979 M.Sc. Microbiology- Mustansiriyah University- 2006

Supervised by

Prof. Dr. Zirak Faqe Ahmed Abdulrahman

Erbil, Kurdistan - December 2022

## SUMMARY

A total of fifty diseased tomato samples were collected from several tomato fields in Erbil and Sulymany Governorates/ Kurdistan Region/ Iraq during the period the 1<sup>st</sup>. April to 30<sup>th</sup>. September 2020. Four fungi represented by *Alternaria* alternata, Fusarium solani, Rhizoctonia solani, and Phoma destructiva, and three bacteria include Pseudomonas syringae, Xanthomonas performance, and Ralstonia solanacearum were isolated from infected tomato and identified using conventional and molecular approach. Four plants include Sumac (Rhus coriaria (Linn.)), Arctium (Arctium lappa), Datura (Datura innoxia Mill), and Rosemary (Rosmarinus officinalis L). were selected and tested for their antifungal and antibacterial activity against isolated pathogens. In vitro evaluation showed varying inhibitory abilities of Sumac, Arctium. Datura and Rosemary extracts against selected pathogens. Sumac and Rosemary extracts were found to be the best among the tested extracts. The calculated % of inhibition revealed that Ethanol 38.8%, methanol 42.2%, acetone 43.7%, and water 42.8% Sumac extracts efficiently inhibits the growth of A. alternata. Acetone sumac extract showed the highest inhibition rate 43.7% against Alternaria alternata, the least inhibition rate 12.9% caused by Sumac ethanol extract against R. solani. The range of inhibition caused by each of ethanol, methanol, acetone, and water extracts from Sumac was 12.9-38.8%, 20.3-42.2%, 15.2-43.7%, and 12.9-42.8% respectively indicating that all Sumac extracts efficiently reduced the fungi growth. Rosemary ethanol 44.9%, methanol 47.2%, acetone 42.7%, and water 40.1% extracts efficiently inhibit A. The methanol extract showed the best action against A. alternata growth. alternata. The lowest inhibition was 5.5% showed by Rosemary ethanol extract against F. solani. The range of inhibition caused by ethanol, methanol, acetone, and water extracts was 5.5-44.9%, 8.7-47.2%, 8.3-42.7%, and 8.8-40.1% respectively. Evaluating the antibacterial activity revealed a high inhibition of 36.5% caused by

Sumac methanol extract against *P. syringae*. The range of bacterial growth inhibition was 25.5-33.3%, 30.4-36.5%, 17.5-27.3% 18.2-24.2% for ethanol, methanol, acetone, and water extract respectively. Rosemary acetone extracts effectively inhibited X. perforans (28.3%). The range of inhibition caused by each of the four extracts was 24.3-28.3%, 12.9-27.5%, 10-28.2%, and 10.4-18.2% for ethanol, methanol, acetone, water extracts respectively. Evaluating MIC against fungal pathogens showed no significant differences between the different concentrations. Testing extracts MIC against bacterial pathogens showed significant differences between the inhibition zones induced by the different concentration. In vivo tests on locally grown tomato cultivars under plastic greenhouse conditions showed that, except for the ineffective action of methanol, and acetone Rosemary extracts, on plants inoculated with R. solani, treatment of tomato plants with Sumac and Rosemary extracts reduced disease severity and significantly improved plant condition. The extracts also, with few exceptions, improved the biomass markers of treated plants. GC-MS and LC-MS Phytochemical of the extracts revealed the presence of abundant amounts of phytochemicals that previously have been proved by many researchers to have significant antimicrobial activity including; Pyrogallol, Benzo[c]coumarine 3,4,8trimethoxy-, 1,2,3-Benzenetriol, Betulin, Galantamine, (+) - 5-Methyl-6(S)-(3)methyl-2-butenyl)tetrahydroimidazo-[4,5,1-jc] [1.4]benzodiazepine-2(1H)one. Many other compounds were found in small proportions. Regardless of the variance in their inhibitory effect, these results confirmed that sumac and rosemary plants possess good inhibitory abilities against the tested plant pathogens making them powerful alternatives to be used as safe and environmentally friendly sources of pesticides.