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ACTIVITY OF LEAVES AND ROOT EXTRACTS OF *CHENOPODIUM ALBUM* AGAINST DAMPING-OFF DISEASE ON BREAD WHEAT UNDER GREENHOUSE CONDITIONS

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Abstract

The aim of this experiment to study the effect water extract concentrations 0, 5, 10 and 15 % of root and leaves of *Chenopodium album* on damping-off disease and some vegetative growth characteristics of *Triticum aestivum* (wheat) infected by fungi pathogen *Rhizoctonia solani* and *Fusarium solani*. The antifungal effects of water extract root and leaves of *C. album* in greenhouse experiments against fungi pathogens, diseases symptoms were not observed or were minimal on wheat when treated with 10 and 15% concentration of *C. album* extract, compared with distilled water treatment at 0% concentration, and that the inhibitory activity increased with increasing concentration. Leaves and root extracts significantly reduced the percentage of pre and post-emergence damping-off caused by Rhizoctonia solani and Fusarium solani respectively on bread wheat compared with the control treatment.

Key words : *Chenopodium album, Triticum aestivum, Rhizoctonia solani, Fusarium solani.*

Introduction

Damping-off disease is one of the most common fungi diseases on field crops and is caused by some phytopathogens such as *Rhizoctonia solani* and *Fusarium solani* (Chaurasia *et al.,* 1999., Ünal and Dolar, 2012., Dürr *et al.,* 2017). They are limited crops production and causes significant yield losses in some field crops such as *Triticum aestivum* (wheat) (Harris and Moen, 1985., Kiecana and Mielniczuk, 2003., García-León *et al.,* 2013). Chemical fungicides have often been used to control these diseases on all field crops in several countries which lead to exert harmful effects on human and negative environmental impacts (Balakumar *et al.,* 2011., Alkooranee and Kadhum, 2019).

Therefore, those interested in plant diseases and environmental protection researched alternative methods of control have been sought biocontrol through the use of plant extracts (Chou, 1999). The potential biological activity of plant extracts and oils has been assessed against a wide range of fungal pathogens on plants, particularly aromatic and medicinal plants contain a spectrum of secondary metabolites such as flavonoids, alkaloids, quinones, saponins, tannins, terpenoids and glycosides with antimicrobial properties (Gahukar, 2012., Gillitzer *et al.,* 2012). In this study, we investigated the activity root and leaves water extracts of *C. album* against *R. solani* and *F. solani* fungi in bread wheat crop.

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Materials and Methods

Laboratory tests

The experiments were carried out in the Microbiology Laboratory, Department of Field Crops, Wasit University, Iraq. Collection the roots and leaves of *C. album* and preparation water extract were used as described in detail previously Alkooranee *et al.,* (2019). For grains of wheat and fungal pathogens, two isolates of phytopathogens fungi *Rhizoctonia solani* and *Fusarium solani* were obtained from the laboratory previously mentioned. Fungi pathogens have been grown at 22 ± 2°C in Potato dextrose agar (PDA) media with autoclaved at 120°C for 20 min. Different concentrations 0, 5, 10 and 15 % of dried powder extraction were prepared from leaves and roots dry powder to 100 ml sterilized distilled water separately. After that, they are ready to use them in

inhibition growth of pathogens fungi.

Greenhouse tests

The seeds of wheat were soaked in 5, 10 and 15 % of root and leaves water extracts of *C. album* and untreated seeds were soaked in sterile water for an hour as control and then ten seeds of each treatment sown separately in plastic pots (30 cm in diameter) contain soil was infested by adding infested millet grains medium at the rate of 5% w:w with the inoculum of each tested fungus separately (Dewan, 1989), and mixed well the pots were maintained under greenhouse. Three pots were used per treatments.

The percentage of pre and post emergence damping-off of seedlings and percentage of disease severity were recorded after 10 and 40 days, respectively from planting. Diseases severity were recorded by using the scale of 0-4 used by (Achenbach and Jennifer, 1996) at the end of the experiment. Fresh and dry (70ÚC for 48 h by electric oven) shoot and root plants weight (gm) were measured on a sensitive electronic weighing balance after 40 days from planting.

Statistical analysis

Data were subjected to statistical analysis and the means ($P < 0.05$) were compared using LSD by using GenStat software.

Results

Activity of Extracts against Damping-off disease caused by *R. solani* in wheat crop

Leaves extracts with *R. solani* pathogen treatments showed table 1 superior reducing effect on pre-emergence damping-off incidence at 5, 10 and 15% where reached 33, 24 and 11% respectively and for root extracts where reached 30, 20 and 15% respectively compared to control treatment reached 60%.

For post-emergence damping-off showed table 1 the treatments with leaves extracts at 5, 10 and 15 % reached 7, 6 and 2% respectively, and with root extracts reached 9, 5 and 3% respectively, compared to control treatment reached 13%. Leaves and root extracts showed a protecting effect against introduced *R. solani* pathogen through in a significant disease reduction at 5, 10 and 15% of leaves extract reached 43.34, 22.18 and 14.53% respectively and reached 38.82, 24.36 and 11.75% of root extract comparing with 67.12% in case of seeds treated with fungal pathogen.

Data also indicate that leaves and root extracts increase shoot and root fresh/dry weight significantly of bread wheat compared with the control treatment (Table 1). The root fresh weight ranged between (0.123-0.163 gm) at leaves and root extract treatments where reached 0.105 gm at control treatment with pathogen. The root dry weight ranged between (0.042-0.091 gm) at leaves and root extract treatments where reached 0.031 gm at control treatment with pathogen.

The shoot fresh weight ranged between (0.837-1.279 gm) at leaves and root extract treatments where reached 0.520 gm at control treatment with pathogen. The shoot dry weight ranged between (0.118-0.387 gm) at leaves and root extract treatments where reached 0.085 gm at control treatment with pathogen.

Activity of Extracts against Damping-off disease caused by *F. solani* in wheat crop

Leaves extracts with *F. solani* pathogen treatments showed table 2 superior reducing effect on pre-emergence damping-off incidence at 5, 10 and 15% where reached 29, 19 and 11% respectively and for root extracts with pathogen where reached 23, 17 and 13% respectively

Table 1: Greenhous screening the effect of *C. album* water extraction on damping off disease caused by *R. solani* fungus in wheat seedlings.

Treatments		Disease incidence %		Disease severity %	Root weight (gm)		Shoot weight (gm)	
		Pre	Post		fresh	dry	fresh	dry
Control		0*	0	0	0.177	0.095	1.370	0.472
R. solani		60	13	67.12	0.105	0.031	0.520	0.085
Leaves	5 %	33	7	43.34	0.127	0.065	0.945	0.118
C. album	10 %	24	6	22.18	0.145	0.084	1.148	0.362
extract	15 %	11	2	14.53	0.168	0.091	1.279	0.380
Root	5 %	30	9	38.82	0.123	0.042	0.837	0.273
C. album	10 %	20	5	24.36	0.155	0.060	0.962	0.342
extract	15 %	15	3	11.75	0.160	0.088	1.173	0.387
L.S.D, 0.05		7.12	3.35	7.32	0.026	0.047	0.223	0.057

*Each number represents a rate of three replicates.

Table 2: Greenhous screening the effect of *C. album* water extraction on damping off disease caused by *F. solani* fungus in wheat seedlings.

Treatments		Disease incidence %		Disease severity %	Root weight (gm)		Shoot weight (gm)	
		Pre	Post		fresh	dry	fresh	dry
Control		0	0	0	0.177	0.095	1.370	0.472
F. solani		56	11	60.37	0.116	0.038	0.558	0.089
Leaves	5 %	29	9	33.84	0.136	0.050	0.952	0.237
C. album	10 %	19	5	20.46	0.155	0.076	1.151	0.282
extract	15 %	12	1	11.50	0.160	0.080	1.295	0.393
Root	5 %	23	8	27.38	0.134	0.042	0.845	0.281
C. album	10 %	17	4	20.26	0.142	0.058	0.973	0.371
extract	15 %	13	1	8.35	0.154	0.074	1.160	0.395
L.S.D, 0.05		6.43	3.16	6.92	0.019	0.028	0.206	0.062

*Each number represents a rate of three replicates.

compared to control treatment reached 56%. For post-emergence damping-off showed table 2 the treatments *F. solani* pathogen with leaves extracts at 5, 10 and 15 % reached 9, 5 and 1% respectively, and with root extracts reached 8, 4 and 1% respectively, compared to control treatment reached 11%.

Leaves and root extracts showed a protecting effect against introduced *R. solani* pathogen through in a significant disease reduction at 5, 10 and 15% of leaves extract reached 33.84, 20.46 and 11.50 % respectively and reached 33.84, 20.46 and 11.50 % for treatments of root extract comparing with 60.37% in case of seeds planted in soil infested by *F. solani* fungal pathogen.

Data also indicate that leaves and root extracts increase shoot and root fresh/dry weight significantly of bread wheat compared with the control treatment (Table 2). The root fresh weight ranged between (0.134-0.160 gm) at seeds were treated with leaves and root extract and infected with pathogen, where reached 0.116 gm at control treatment with pathogen. The root dry weight ranged between (0.042-0.080 gm) at leaves and root extract treatments where reached 0.038 gm at control treatment with pathogen.

The shoot fresh weight ranged between (0.845-1.160 gm) at leaves and root extract treatments where reached 0.558 gm at control treatment with pathogen. The shoot dry weight ranged between (0.237-0.395 gm) at leaves and root extract treatments where reached 0.089 gm at control treatment with *F. solani* (Table 2).

Discussion

There has been constant increasing of gradual replacement of pesticide chemicals through the alternative efficient bio-compounds for plant disease control, The use of plant extracts is one of the most important goals of those interested in the fight against plant diseases as they have worked constantly in the development of new plant extracts that act as catalysts for systemic resistance or as a treatment for various diseases. In these greenhouse conditions experiments, we have study the efficacy of highly effective leaves and root extracts of *C. album* on wheat damping-off disease. Data in (Table 1, 2) reveal that leaves and root extracts significantly reduced the percentage of pre and post-emergence damping-off caused by *R. solani* and *F. solani* respectively on bread wheat compared with the control treatment. These results are consistent with previous studies where plant extracts have been reported as the one of bio-control agent for damping-off disease on field crops, twenty powdered spice plants and their *extractsof carnation*, *cinnamon*, *garlic*, and *thyme* against faba bean damping-off caused by *R. solani* and *F. solani* (El-Mougy and Abdel-Kader, 2007), aqueous extract of *Asclepias sinaica*, *Phagnalon sinaicum*, *Hypericum sinaicum*, *Farsetia aegyptia*, and *Salvia aegyptiaca* can be used to treat wheat grains to reduce pathogen infection (Baka, 2014). Neem leaf, allamonda leaf, katamehedi leaf, kalijira seed, ginger rhizome, turmeric rhizome, garlic clove, onion bulb and bel leaf extracts were used against damping-off disease of some winter vegetable eggplant, tomato and chilli seedlings (Islam and Faruq, 2012).

Fusarium oxysporum, *F. solani*, *F. acuminatum*, *F. equiseti*, *F. compactum*, *Phoma lycopersici*, *Macrophomina phaseolina*, *Rhizoctonia solani* and *Cephalosporium* sp. were isolated from tomato seedlings were infected with damping-off disease while the *Hypericum triquetrifolium* extract showed inhibition mycelium fungi growth and lead to high effects on dry and fresh weight and plant height when compared to

control treatment (Ismael and Mahmood, 2016). Our results are similar to those that indicate that the use of plant extracts may significantly decrease damping-off in seedlings of diverse species produced under greenhouse conditions.

There were no significant differences between concentration treatments 5, 10, 15 %. This result suggests that the *C. album* substrate discourages damping-off disease. It has been reported that *C. album* contains 7 antimicrobial agents: 9,12-octadecenoic acid (Z), methyl ester; 9-octadecenoic acid (Z), methyl ester; 2(3H)-furanone, dihydro-4,4-dimethyl; 6-methylene bicyclo (3.2.0) hept-3-en-2-one; 1,2-benzene dicarboxylic acid; mono (2-ethylhexyl) ester and hexadecanoic acid, methyl ester that could have an effect on controlling damping-off (Alkooranee *et al.,* 2019). Similarly, studies found C. album has been to have alkaloid chinoalbicin, phenolic amide, apocortinoid, saponin, lignans, phenols,cinnamic acid amide and xyloside as active phytoconstituents (Agrawal *et al.,* 2014).

Conclusion

This study concluded that the water leaves and roots extract of C. album can be managed many important diseases that affect the fields of wheat and can also be used as an environment-friendly fungicide instead of using the pesticides.

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