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Evaluation of the Efficiency of some Botanical Oils in Controlling wilt and Root Rot Disease in Pepper Plant Caused by *Fusarium solani*

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Abstract. The study aimed to test the effectiveness of castor and eucalyptus oil against the causative agent of wilting and root rot in pepper caused by the fungus *Fusarium solani.* 3) %, The eucalyptus oil treatment outperformed the rest of the treatments with significant differences at a concentration of 3%, as the percentage of inhibition in the laboratory reached 64.5%, compared to the control treatment, as the percentage of inhibition reached 0%. The eucalyptus oil treatment at a concentration of 3% was superior to the rest of the treatments in reducing the severity of infection on the vegetative and root system, reaching (0.9, 4.92%), followed by the castor oil treatment at a concentration of 3%, as the severity of infection on the vegetative and root system reached (7.88, 1.6). % compared to the control treatment It reached (11.54, 2.56)%, respectively. The results also showed that all control treatments had a positive effect on plant growth parameters after 30 days of planting and differed significantly from the comparison treatment.

Keywords. Eucalyptus oil, Castor oil, Pepper plant.

1. Introduction

Capsicum annuum L. is solancious crop of a high marketing value [1]. It is native to Central and South America, and from there its cultivation spread to the rest of the world [2]. Therefore, attention was paid to it and fertilizers were added to it for the purpose of increasing production and disease resistance [3].

It is grown in Iraq by open cultivation at the beginning of spring and Green houses at the beginning of autumn.Pepper is the third most important crop of the Solanaceae family after tomatoes and potatoes. It is eaten fresh or in salads. It is also used in pickling, stuffing and sauce. Each 100g of its fresh fruit contains 4.8% carbohydrates and 1.2% protein, in addition to iron, potassium and calcium salts, as well as fluorine, which prevents tooth decay. [4] Green pepper is considered one of

the richest of all vegetables in vitamin C [5]. The pepper crop is exposed at all stages of growth to a number of diseases,[6,7] the most important of which is wilting and rotting of roots and stems caused by a number of mainly pathogenic soil settlements, including Fusarium oxysporum - Fusarium solani - Macrophomina phaseolina - Pythium spp - Phtophthora spp and Rhizctonia solani [8,9] Typical symptoms of root and stem rot disease induced by the fungus *Fusarium solani* on pepper are red streaks on the roots, after which cracking occurs and the main root and root hairs are colored dark brown. Gradual rotting occurs and the infection reaches the base of the stem, but this discoloration does not extend to the carrier wood vessels, after which symptoms appear. On the vegetative mass, the leaves yellow, dwarf and wilt the plant [10].

2. Materials and Methods

2.1. *Isolation of F.solani Fungus from Infected Pepper Plants*

The fungus F. solani was isolated from infected pepper plants from plastic houses in the Yusufiyah region, showing symptoms of wilt disease. The samples were kept in plastic bags and brought to the plant pathology laboratory. The infected samples were washed with running water and then sliced into 0.5 cm pieces, superficially disinfected with hypochlorite solution sodium (1% free chlorine) for 2 minutes, washed with sterile distilled water (SDW) and dried on sterilized filter paper. It was planted in dishes containing Potato Dextrose Agar (PDA) medium, which was prepared (39 gm of the food medium per 1 liter of water). The dishes were incubated at a temperature of 25 °C for three days. After the emergence of colonies, an isolation process was carried out. of fungus colonies using a fresh and sterile PDA medium to obtain pure colonies.

2.2. *Diagnosis of Fungus Using Light Microscopy*

The method [11] was adopted in the morphological and microscopic diagnosis of the fungus F. solani. The fungus was grown by transferring a disk (1 cm) from the edge of a fresh fungal colony of pure isolation to the middle of a petri dish containing PDA and kept for five days in the incubator at At 25°C, after the end of the incubation period, the color of the fungal colony was examined, then examined microscopically to see the fungal filament and the shape of macroconidia, microspores, and chlamydospores.

2.3. *Testing the Pathogenicity of F.solani on Pepper Seeds in Vitro*

The experiment was conducted in laboratory conditions to test the pathogenicity of Fusarium solani isolate. The fungus was grown in Petri dishes with a diameter of 9 cm by placing a 0.5 cm disc taken by a cork puncture from the growing fungus on PDA medium at the age of 5 days and placed in the middle of the plate and incubated for 3 days at 25 C. About, 20 seeds of pepper, variety Carisma, were sown at a distance of 1 cm from the edge of the plate, after sterilizing them superficially with sodium hypochlorite solution at a concentration of 1% for 2-3 minutes, then rinsed with SDW twice, dried, and 3 dishes were made. Seeds were sown without the presence of the pathogenic fungus isolate. The plates were incubated for 7 days at 25 °C for a period of 7 days. Data were collected through calculating the seed germination percent according to the following equation:

Germination percentage = number of germinated seeds / total seeds sown

2.4. *Evaluation of the Efficiency of (Eucalyptus and Castor) Oils in Inhibiting the Growth of Fusarium solani Under Laboratory Conditions*

The control agents represented by oils (eucalyptus, castor) against the fungus Fusarium solani were tested using the poisoned food media technique, as 3 replicates were made for each treatment, with 3 concentrations (1, 2, 3)% for each treatment, leaving one treatment without treatment as a control. As I used glass beakers with a capacity of 100 ml containing the sterile PDA culture medium, then adding different concentrations of control agents before solidifying the medium in the beakers, and shaking them in a regular circular motion to ensure the homogeneity of the contents, then pouring the medium into Petri dishes with a diameter of 9 cm. As for the comparison treatment, it was represented by

the culture medium PDA only The center of each plate was inoculated with a 5 mm disc from the edge of the colony of the pathogenic fungus at the age of 5 days, and the plates were incubated at a temperature of 25 °C. Readings were taken 7 days after inoculation, and inhibition percentage was calculated for all treatments following the equation

Inhibition percentage = average control diameter - average treatment diameter / average control diameter

2.5. Efficiency of Control Agents in Reducing the Severity of Pepper Root Rot Disease Caused by Fusarium solani

Pot experiment was performed in the greenhouse of the Plant Protection Dept. / Coll. of Agri. Eng. Sc. / Univ. of Baghdad. Mixed soil was sterilized with (2:1) w/w by the autoclave for an hour and for two consecutive times.

Pots with a diameter of 20 cm were used for cultivation, and the best effective concentrations of control agents were chosen in the laboratory and applied in the pots. The fungal suspension was added to the soil at a concentration of 10 6 spores / ml, as the spores were counted by Haemocytometer method. 30 ml were added to each pot, and the pots were covered with perforated polyethylene bags for 3 days. While maintaining relative humidity by spraying the soil with water using a hand sprinkler, then I planted pepper plant seedlings at the age of 4 weeks, Carisma variety, by 3 seedlings per pot.

Control agents were added, as they were prepared at a concentration of 3% by adding 30 ml / liter mixed with 25 ml / liter of Dimethyl sulfoxide and supplementing the volume with distilled and sterilized water to 1 liter [12] after one day of cultivation and the process was repeated 15 days after the first control with leaving the comparison treatment (soil + fungus), Ortiva top fungicide was also used for comparison with the dose recommended by the producing company without addition. The disease severity was estimated on the vegetative total of the plant weekly for four readings. As for the roots, the severity of the infection was calculated after 30 days of cultivation following Mckinney equation. 1923.

Disease severity on root system was estimated following disease index: 0 = healthy roots, 1 = light brown secondary roots, 2 = dark brown secondary roots with light brown part of the main root, 3 = dark brown main root with stem base, 4 = primary root rot And the entire base of the stem is dark brown in color, 5 = the death of the entire plant The infection severity of the vegetative system was estimated using the pathological index: 0 = healthy plant, 1 = 1 - 25% yellowing of leaves, 2 - 26 - 50% yellowing and wilting of leaves, 3 = yellowing and wilting of 51 - 75% of the leaves, 4 = 76 - 100% of the leaves. Selected growth parameters were measured including leaf area and the fresh and dry weight of the seedlings.

3. **Results**

3.1. *Isolation and Identification of Fungus*

The fungus Fusarium solani, isolated from infected pepper plants, was identified based on the morphological and microscopic characteristics. The upper surface of the isolated colonies showed a density of mycelium and a white color. As for the microscopic characteristics, it appeared as a result of the microscopic examination The presence of fungal structures represented by large macroconidia with a crescent shape, which is considered one of the distinguishing characteristics of the presence of the fungus, in addition to the small conidia microconidia that appear oval to spherical in shape We did not see chlamydospores, as the fungus remains in the soil for long periods, retaining its vitality in the form of chlamydial spores.

3.2. *Testing the Pathogenicity of F.solani on Pepper Seeds in Vitro*

The laboratory results showed a significant decrease in the percentage of germination of pepper seeds, as the Fusarium solani isolate was superior to the control treatment in reducing the percentage of germination, as the number of germinated seeds was 0 and the percentage of germination was 0% compared to the control treatment, as the germination rate was 100%.

The reason for the ability of the fungus isolate to inhibit the germination of seeds is due to the secondary metabolites secreted by the fungus, such as its ability to secrete pectin and

cellulose-degrading enzymes, which leads to rotting of seeds and preventing them from germinating, as well as its ability to produce mycotoxins that kill seed embryos, such as Fusaric acid and Javanicin, which have a role in causing the disease, as they inhibit the action of enzymes and the permeability of cell membranes, and act as an antidote that leads to a deficiency in germination factors [13].

3.3. *Evaluation of the Efficiency of Eucalyptus and Castor Oil in Inhibiting the Growth of Fusarium solani Under Laboratory Conditions*

The results of Table (1) showed the efficiency of the control agents used in inhibiting the growth of mycoses of pathogenic fungi represented by oils (eucalyptus, castor) for three concentrations (1, 2, 3)% As well as the control treatment after 7 days of incubation, as the percentage of inhibition of castor oil was (30.2, 38.1, 49.4)%, respectively, while the eucalyptus oil recorded an inhibition percentage of the fungus (39.8, 53, 64.5)%, respectively, and the treatment of eucalyptus oil excelled over the rest. The treatments showed significant differences at a concentration of 3%, with a decrease in the percentage of inhibition of the pathogenic fungus, as the concentration increased using the poisoned media method, compared to the control treatment, in which the percentage of inhibition was 0%.

These results agree with what the researcher Saeed et al., 2004 concluded, that castor oil contains a highly toxic compound for fungi, which is ricinolec acid. As for the effectiveness of eucalyptus oil, it is due to the oil containing Eucalyptol, which is the active ingredient responsible for the effectiveness of the oil against fungi and some other microorganisms[14] .

Table 1. Evaluation of the Efficiency of (Eucalyptus and Castor) Oils in Inhibiting the Growth of Fusarium solani Under Laboratory Conditions.

Treatment	Concentration %	Inhibitionpercentage%
Castor oil	1	25.2
	2	33.1
	3	59.4
Eucalyptus oil	1	34.8
	2	48.1
	3	74.5
Control	Without addition	9
L.S.D.	0.482	

3.4. *Efficiency of Control Agents in Reducing the Severity of Pepper Root Rot Disease Caused by Fusarium solani in Pots Under Greenhouse Conditions*

The results are shown in Table 2. All the control agents used had a significant effect on reducing the severity of infection with the Fusarium solani of pepper root rot compared to the control treatment contaminated with the pathogenic fungus only. 4.92, 0.9 (%), respectively This was followed by castor oil treatment with a concentration of 3%, as the severity of the infection on the vegetative and root system reached (7.88, 1.6)%, respectively. As for the pesticide treatment, the severity of the infection on the vegetative and root system reached (8.89, 1.8)%, respectively, with the recommended dose compared to the control treatment (fungus). Only), the infection intensity of the root and vegetative total reached (11.54, 2.5)%, respectively.

The reason for the superiority of the treatment of eucalyptus oil is due to the fact that the oil contains eucalyptol, which is the active ingredient in the oil [14], and it was found in a study that eucalyptus oil contains Kinoin, which has antifungal activity [15] As for the effectiveness of castor oil, it is due to its containment of ricinoleic acid, which is the main component of the oil, which is characterized by its toxicity against fungi The results also showed that all control treatments had a positive effect on the growth parameters of pepper plants in terms of plant height, plant leaf length and width, fresh and dry weight

after 30 days of planting seedlings, as they differed significantly from the control treatment.

Table 2. Efficiency of control agents in reducing the severity of pepper root rot disease caused by Fusarium solani in pots under greenhouse conditions.

Treatment	Plant height /cm	Leaf length / cm	Leaf width / cm	Soft weight /gm	Dry whight / gm	Severity of root %	Severity of vegetable %
eucalyptus	24.87	6.27	3.83	4.73	0.65	0.9	4.92
castor	22.96	5.24	3.29	3.89	0.49	1.6	7.88
Pesticide	24.33	4.83	2.89	3.95	0.54	1.8	8.89
Control	20.67	3.39	2.67	3.55	0.39	2.5	11.54
L.S.D.	3.71	1.13	0.63	1.81	0.14	1.7	.2.37

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