

Effect of Some Biological and Chemical Treatments in Controlling Date Palm Fruit Rot Disease

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Abstract. The College of Agriculture, University of Basra/Department of Plant Protection performed the 2021-2022 research. with the goal of testing biological and chemical therapies for date palm fruit rot in Sayer and Khadrawi cultivars. Bioagents included bread yeast *Saccharomyces cerevisiae*, *Cheatomium globsum*, and chitosan nanoparticles. Chemical treatments included silver nanoparticles. *Cheatomium globsum* + silver nanoparticles had the lowest average infection rate of 4.82%, compared to 36.62% for the control treatment. Neither variety differed significantly. The statistical analysis of the interaction between the study treatments variety showed significant differences between them, as the treatment of *cheatomium globosum* + silver nanoparticles reduced the average percentage of disease infection to 3.83% and 5.80% compared to the control treatment, which had an average infection rate of 36.23% and 37.00% for Al-Sayer and Khadrawi, respectively. The Control treatment had the highest average latent infection rate of 81.67%, while the *cheatomium globosum* and silver nanoparticles treatment reduced it to 12.83%. Khadrawi had 38.525 latent infected rats of date palm fruit rot, whereas Syer had 33.71. The other cultivar had the lowest latent incidence of palm fruit rot disease at 33.71%. The average was 38.52%. Experimental treatments did not interact significantly.

Keywords. Chitosan, Yeast, Silver nanoparticles, Fruit rot, Palm fruits.

1. Introduction

Dates are one of the fruits that stands out due to their high nutritional content; they include antibacterial components and antioxidant chemicals and have a part in warding off infections and gastrointestinal illnesses. Safe access to food [1]. Dates are infected during their different growth stages, like other fruits, with several fungi that cause damage, rotting and falling of the fruits. Palm fruit rot disease is caused by several fungi, the most important of which are *Aspergillus spp.*, *Penicillium*, *Alternaria spp.*, *Rhizopus spp.*, and others [2]. Palm fruit rotting diseases cause losses ranging between 5-45%, depending on the availability of appropriate conditions for infection with these fungi [3]. However, the greatest damage to these fungi comes from the ability of these pathogens, especially *Aspergillus* and *Penicillium*, to secrete toxic compounds known as mycotoxin. Fungal toxins, the most important of which are Aflatoxin and Ochratoxin [4]. The control of palm fruit rot diseases is one of the challenges facing.

those interested in the palm sector in general and those working in the field of plant diseases in particular, because the infection most often occurs at the stage of turning the fruits from Khalal to rutab stage, which makes it difficult to use safe chemical pesticides. Biological control has received increasing attention in recent years as it is safer for the environment and less harmful to human health [5]. Several studies were also conducted on the exploitation of some types of yeasts in the field of biological control of plant pathogens. The yeast *Candida aleophila* and *C. diversa*, *C. saitoana*, and other species in the control of post-harvest diseases of apple, citrus, and stone fruit [6-8] The effectiveness of bread yeast is due to the increase in the activity of Chitinase and Glucanase enzyme and its stimulation of systemic resistance in fruits. [9,10] Nanoparticles, especially silver nanoparticles, are considered promising methods in control plant diseases. These compounds are characterized by their small size, large surface area, and easy penetration into the cell walls of fungi and plant pathogenic bacteria [11,12]. Chitosan has also received increasing attention in recent years for its ability to inhibit the growth of pathogenic fungi and induce systemic resistance in plants [13]. Chitosan is a naturally occurring compound that has no harmful effects on the environment and human health [14].

Due to the importance of dates and the need for them to be free of pesticide residues. the idea of this research came with the aim of evaluating the efficiency of some treatments of baking yeast, *Chaetomium* fungus, chitosan and silver nanoparticles in control palm fruit rot disease.

2. Materials and Methods

The study was conducted at the Agricultural Research Station of the College of Agriculture, University of Basrah. Nine palm trees were selected from each of Al-Sayer and Al-Khadrawi cultivars. Each palm tree contains at least six trunks. Two trunks were allocated from each tree for each experimental treatment.

The experiment was carried out when the fruits reached full growth the final stage of Alkalal, The experiment included the following treatments: (bread yeast treatment, chitosan treatment, silver nanotreatment, *Chaetomium* fungus, yeast + chitosan, yeast + silver, yeast + silver, chitosan + silver, chitosan + *Chaetomium*, silver + *Chaetomium*, control treatment).

.Yeast suspension was prepared by adding two plates of yeast growing in PDA medium to 100 ml of Distilled water water, and the used concentration was adjusted (100 ml of Distilled water spores/ml) using a Haemocytometer. *Chaetomium* fungi suspension was prepared in the same way, while silver nanoparticles were used at a concentration of 100 ppm

The experiment was carried out in three replications for each treatment. The infection rate was calculated by taking ten spikelet from each treated trunk The infection rate was calculated from the following equation:

$$\text{Infection percentage} = \frac{\text{number of infected fruits}}{\text{The number of total fruits calculated}} \times 100$$

In the end of the experiment fungi were also isolated from infected fruits on PDA medium.

2.1. Effect of Some Biological and Chemical Treatments on the Percentage of Latent Infection

This experiment was carried out with the aim of evaluating the efficiency of some biological and chemical treatments in infecting palm fruits with some fungi without showing symptoms. The experiment was carried out according to the method a [15].

Thirty fruits in the khalal stage and thirty fruits in the mature (date) stage were collected from each treatment group. Every ten khalal or dates were sterilized by dipping them in a 10% sodium hypochlorite solution and then placing them in a plastic container with a tight-fitting lid that contained sterile blotting paper moistened with distilled water. After making two holes in each container on opposing sides and plugging them with sterile cotton, the fruit was kept at room temperature (22-25 degrees Celsius) to ripen. After 3 and 5 days, we looked at the fruit and used the prior calculation to determine what proportion of them had been infected.

3. Results and Discussion

3.1. Effect of Biological and Chemical Treatments in Controlling Date Palm Fruit Rot Disease

Analysis using statistical methods Table (1) shows that when palm fruit rot disease was treated with *cheatomium globosum* and silver nanoparticles, the percentage dropped from 40.9% in the control treatment to 4.82%. The average proportion of palm fruit rot disease was (14.09%) across both the Al-Sayer and Al-Khadrawi cultivars, showing no statistically significant variations between the two.

The treatment of cheatomium globosum + silver nanoparticles had the lowest percentage of infection (3.8% in the Alsayer cultivar and 5.8% in the Kadrawi cultivar on average) compared with the other treatments (36.23%-and 37.00% for both varieties, respectively). This may be due to the fact that silver nanoparticles may cause damage to the cell wall or the fungal cell membrane, or damage organelles such as mitochondria and ribosomes when they penetrate into the cells of the Pathogenic fungus, or may cause a change in the nature of chromatin, causing damage to The cells of fungi [16].

[17] reported that silver nanoparticles synthesized AgNPs are able to inhibit the growth of plant pathogenic fungi *Penicillin digitatum*, *Aspergillus flavus* and *Fusarium oxysporum*, and the effect of inhibition increased with increasing AgNP concentration. Silver nanoparticles AgNPs showed antifungal activity Of several plant pathogenic fungi plant pathogens [18].

In another study, it was reported that *Cheatomium spp* isolated As endophytic fungi stimulated the production of secondary metabolites such as alkaloids. [19].

The ability of bread yeast to reduce infection with some post-harvest fungi is due to its ability to produce enzymes that lyse the walls of fungal and its ability to compete with pathogenic fungi for nutrient and space [20,21].

Table 1. Effect of some biological and chemical treatments on the percentage of infection with date palm fruit rot disease.

Varieties/ Transactions	Percentage of palm fruit rot disease		Average transactions
	Al-Sayer	Khadrawi	
Control treatment	36.23	45.6	40.9
yeast	19.43	22.77	21.10
Cheatomium globsium	14.77	18.77	16.77
Chitosan	18.7	15.27	15.90
AgNps	11.43	8.10	9.77
Yeast+AgNps	8.37	6.33	7.35
yeast+ chitosan	8.87	12.1	9.58
Cheatomium+ chitosan	7.37	10.2	7.52
Cheatomium+AgNps	3.83	5.80	4.82
Average peduncle	14.09	14.67	14.38
L.S.D == 0.05	0.419		0.889
	To overlap :1.258		

3.2. The Effect of some Biological and Chemical Treatments on Latent Infection with Fungi that Cause Date Palm Fruit Rot Disease

Table (2) displays the statistical analysis results showing that there were statistically significant differences in the percentage of latent infection with fungi that cause palm fruit rot disease as a result of the effect of the treatments, with the control treatment recording the highest average latent infection of 81.67 percent and the cheatomium + silver nanoparticles treatment recording the lowest average latent infection rate of 12.83 percent. cultivar had an average latent infection rate with palm fruit rot disease of 38.52 percent, the highest of all tested.

The Interaction of the study treatments did not record any significant differences between them. The results of this study agree with [22], that silver nanoparticles reduced Radial growth of *F. oxysporumv* in vitro [23]. showed the effect The effect of silver ions in inhibiting the growth of fungi *Bipolaris sorokiniana* and *Magnaporthe grisea* that cause *Lolium perenne* leaf spot disease [24]. also reported that biosynthetic silver nanoparticles had antimicrobial effects against eighteen species of plant pathogenic fungi isolated from fruits and vegetables.

And that the effectiveness of silver nanoparticles may be due to the mechanism of action of silver ions in inhibiting the activity of microorganisms by reducing the ability of DNA to replicate when treated with AgNPs [25], as well as inhibiting cysteine-containing proteins, which causes physiological and biochemical damage in plasma membrane and cell death (26) as well as inhibition of proteins and enzymes essential for ATP production (27,26).

[28] indicated that *Chaetomium globosum* Has anti fungal activity against apple scab fungus of apple scab (*Venturia inaequalis*) under field conditions [29] reported that the use of *Cheatomium globsum* reduced the growth of bacteria and fungi through competition for space and food, fungal parasitism, and antibiotics, through secondary metabolites.

Table 2. Effect of some biological and chemical treatments on latent infection with fungi that cause rotting of date palm fruits.

Varieties / Transactions	The percentage of laten infection		Average transactions
	Al-Sayer	Khadrawi	
Control treatment	78.33	85.00	81.67
yeast	51.10	64.00	57.55
Cheatomium globsium	36.67	44.33	40.50
Chitosan	33.33	38.33	35.83
AgNPS	23.33	30.33	26.83
yeast+ AgNps	21.67	27.7	21.67
yeast+ chitosan	34.3	31.67	32.50
Cheatomium+ chitosan	14.00	17.33	15.67
Cheatomium+AgNps	11.67	14.00	12.83
Average peduncle	33.71	38.52	36.12
L.S.D 0.05 =	2.231		4.732
	To overlap :6.692		

Conclusion

Cheatomium globsium and silver nanoparticles reduced the percentage of infection and the latent infection rate of palm fruit rot disease, Alsayer varities showed a higher response to the control factors than the Kadrawi.

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