

SURVEY ON DATE PALM-TREES DISEASES (PHONENIX DACTYLIFERA) STUDY AND FUNGAL-LEAF SPOT DISEASES CONTROL

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Abstract. A laboratory study and field survey of palm trees scattered in Tikrit University, Iraq was conducted during the year 2016. The study included a field survey of palm trees infected with leaf spotting and their control with fungicides and pesticides. The survey study showed that all colleges of Tikrit University and its accompanying are infected with fungal diseases as they reached the highest percentage. The percentage of infected palm trees is 100% in the College of Arts, Veterinary Medicine and Dentistry, the College of Administration and Economics and the Faculty of Physical Education, while the laboratory study demonstrated the efficacy of the pesticide Tobin to inhibit the pathogenic fungi causing the leaves to spot at a concentration of 0.2 ml/liter as the rate of inhibition was zero cm for the fungi *F. moniliforme* and *F. oxysporum* compared to the control treatment was 6.1 and 5.3 cm, respectively, while the fungus showed *Alternaria* sp. High resistance against the pesticide action of the same concentration, as the percentage of inhibition reached 3.35 cm. As for the pesticide, two trees showed high efficiency against fungi causing leaf spotting, as the rate of inhibition was zero for fungi *F. moniliforme* and *F. oxysporum*. *Alternaria* sp at concentration 0.3 ml/litre.

Keywords: *palm trees, leaf spot disease, fusarium solani, alternaria sp*

Introduction

The date palm, *Phonenix dactylifera*, is one of the subtropical fruit trees of the *Arecaceae* family, which occupies a high position economically, especially in the agricultural sector at the local and global levels, especially the Arab one, and specifically in the Arab Gulf countries in particular, because its fruits contain unique nutritional value, such as mineral salts and sugars; and some vitamins, in addition to the presence of a percentage of proteins (Abdullah et al., 2010; Oostendorp et al., 2001). Fungal spot diseases that affect palm trees are among the most widespread diseases, whether on shoots or on fruiting palms. It has been observed in Algeria, Morocco, Tunisia, Iraq, Oman, Iran, and the states of California and Arizona in America. It may be found in many other countries (Abass, 2016). The importance of fungi that cause leaf spot diseases lies in the fact that they target the manufacture of food necessary for growth, represented by the process of photosynthesis, which takes place in the leaf (Watanabe, 2006). Symptoms of fungal spot diseases vary depending on the cause of the disease, and many fungal genera have been recorded as effective causes of this disease, such as black spot disease caused by *Chaetosphaeriosis* sp (2). Brown (Kader and Hussein, 2009) spot disease caused by *Alternaria alternata* (Naderi and Abedi, 2012) and leaf spot disease. The cause is *Uocladium atrumpestalotia* (Akhtar et al., 2004) and spot disease is caused by *Phoma glomerata* and *Fusarium solani* (Abass,

2016). In view of the importance of palm trees in Iraq and many other countries and the importance of the diseases that affect them, causing losses in the productivity of these trees in general, and in view of the lack of care for the palm trees spread in Tikrit University due to the terrorist acts that took place in the governorate, which led to their infection with a number of pathogens, the aim of this research is to: (1) conduct a general survey of palm tree injuries in all university colleges and identify these injuries; (2) isolate and diagnose the fungi that cause spot diseases on all parts of the palm tree; (3) evaluating the efficiency of a number of fungicides at different concentrations for the purpose of determining the best pesticides that inhibit the growth of pathogenic fungi and recommending their use in control; and (4) contributing to providing solutions for infected palm trees as a service to the University and the beauty of its gardens.

Materials and Methods

Survey of date palm infections at the sites of Tikrit University and its colleges

A palm tree survey was conducted at the sites and colleges of Tikrit University for the period from 2/28/2016 to 3/15/2016. Through the disease symptoms on the palm trees, the numbers of infected and healthy palm trees were recorded for each site and college, then the percentage of infected trees in each college was extracted according to the following equation:

$$\frac{\text{Number of infected trees}}{\text{Total number of trees}} \times 100 \quad \text{Eq. (1)}$$

Preparation of fungal growth medium Malt Dextrose Agar (MDA)

Prepare the malt dextrose agar (MAD) medium by dissolving 50 g of the ready-made medium (Hi Media Company of India) in one liter of distilled water, then sterilize the medium in an autoclave at 121 °C at a pressure of 1.5 bar for 15 minutes, then cool the medium to 40 °C. Then the antibiotic Ampiclox was added at a rate of 100 mg/L to the medium, and finally the medium was poured into Petri dishes and left to solidify at room temperature.

Isolation, purification and diagnosis of fungi from palm tree fronds infactedwith spot disease

Samples were taken from different fronds of date palm trees from different locations from Tikrit University and its colleges in Salah al-Din Governorate. They showed symptoms of fungal spot disease. They were taken to the plant pathology laboratory at the College of Agriculture-Tikrit University during the year 2016. Plant samples were taken after washing them with distilled water into small pieces (1-2 cm) and was surface sterilized with 10% sodium hypochlorate solution for three minutes. It was washed again with sterile distilled water. The plant samples were distributed at a rate of 3 samples/plate on malt extract agar medium (malt dextrose agar) (*Figure 1*). Growth was monitored daily, and after the fungi grew and appeared clearly, the fungal isolates were purified by transferring part of the growing colony to the MA culture medium prepared

according to what was mentioned above. Then the purified fungi were identified based on the fungal hyphae and the colors and shapes of the conidia and their carriers according to the available taxonomic keys (Watanabe, 2002).



Figure 1. Fungi isolated from palm trees.

Studying the effect of some fungicides on the growth of fungi that cause spot ex vivo (In vitro)

The fungi *Fusarium moniliforme*, *Fusarium oxysporum* and *Alternaria sp* were selected because they appeared with the highest frequency in the results of isolation on palm trees to determine the effect of pesticides on their effect. The pesticides whose characteristics are shown in *Table 1* were chosen. These pesticides were used at three concentrations, including the concentration recommended by the companies that produce them, and +50 and -50% of the recommended concentrations. The culture media (MAD) were prepared in flasks with 100 ml for each flask. They were sterilized with a steam sterilizer after adding the antibiotic Ampiclox. The media were treated with pesticides according to the concentrations mentioned above. The media was poured into Petri dishes based on each concentration in 6 dishes, in addition to the control treatment devoid of pesticide concentrations. The dishes containing the media were inoculated with the isolated fungi separately, with two replicates for each fungus and the control treatment two replicates. After the growth in the control treatment reached the edge of the dish, the growth of the fungi was measured by measuring two perpendicular diameters of the growth of the fungal colony and extracting at the rate of diameter (in centimetres).

Table 1. The pesticides used, their active ingredients, and recommended concentrations.

Recommended concentration	Company product	Effective material (in percentage %)	Chemical group	Common name	Chemical pesticide
0.15	Vapco(Jordan)	30	Isoxazol	Hymaxozol	tashjarayn
0.1	Nippon soda .co.ltd	70	Systemic fungicides	Thiophanate methyl	Topsin M

The experiment was carried out using the *Khastawi* variety by bringing samples representing date leaves. They were washed well with distilled water and then re-sterilized superficially with 70% ethyl alcohol. The author made scratches with a (sterile knife) on parts of the leaf at a rate of 10 scratches/2 cm distance between each scratch. The samples were treated with pesticides. According to the mentioned concentrations, by spraying the leaves with the pesticide, the leaves were inoculated with the fungi selected from the isolate, and for each treatment there were two replicates with the control treatment free of the pesticide (by inoculation only). Each leaf was placed in 500 ml bottles containing 10 ml of water, and its nozzles were closed for the purpose of

providing moisture and maintaining the vitality of the leaves. After an incubation period of 5-7 days, the percentage of infection was extracted as in the following equation:

$$\text{Percentage of infection} = \text{Number of affected spots} / \text{Total number of spots} \times 100 \quad \text{Eq. (2)}$$

Statistical analysis

A factorial experiment was conducted that included the pesticide concentration factor and the fungus type factor, and the results were analyzed using ANOVA, and the means were compared according to the least significant difference test under the 0.01 probability level (Watanabe, 2002; Al-Sahuki and Karima, 1990).

Results and Discussion

Numbers and percentages of infected palm trees at the sites of Tikrit University and its colleges

Table 2 shows the numbers and percentages of infected palm trees at the level of Tikrit University. This table shows that all the sites that were surveyed, including colleges, the road leading to the university gate, and the gardens of the university presidency, had higher numbers of infected trees than healthy trees. The percentage of infection in palm trees reached 100% in the gardens of the College of Physical Education (6 infected trees out of 6 trees), the gardens of the College of Arts (18 infected trees out of 18 trees), and the gardens of the College of Administration and economics (with 22 infected trees out of 22 infected trees) and the College of Veterinary Medicine (with 15 infected trees), but dentistry (with 3 infected trees) follows that, as the percentage of palm trees infected reached 90.3, 88.9, 82.6, 81.4, 79.8, 79.0, 76.2% at the site of the College of Education, College of Mathematics and Computer, University Presidency Gardens, College of Engineering, University Road, College of Agriculture, and College of Law, respectively, while the lowest infection rate was 68.7% in the College of Pharmacy. The total number of infected trees reached 428 palm trees out of a total of 520 palm trees, with the infection rate reaching 83.31%. The most important reason that may be attributed to the high rate of infection of palm trees at Tikrit University is the lack of care for them as a result of the terrorist acts that took place in Salah al-Din Governorate, including irrigation, fertilization, and pest control, which led to their infection at high rates.

Table 2. Numbers and percentages of infected palm trees at the sites of Tikrit University and its colleges.

The college	Number of infected palm trees	Number of healthy palm trees	Percentage of infected trees
College of Engineering	35	8	81.4
College of Science	9	3	75
Faculty of Physical Education	6	0	100
School of Law	16	5	76.2

College of Literature	18	0	100
Faculty of Administration and Economics	22	0	100
Faculty of Agriculture	132	35	79
College of Veterinary Medicine	15	0	100
Faculty of Education	28	3	90.3
Faculty of Dentistry	3	0	100
Faculty of Pharmacy	22	10	68.7
Faculty of Mathematics and Computers	16	2	88.9
University Presidency	19	4	82.6
Gardens The Road Leading to the Gate	87	22	79.8
The total	428	92	83.31

It is observed in *Figure 2* that the yellowing of the leaves begins from the base towards the top. Sometimes the yellowing is observed spreading in random locations on the leaflets, and the yellowing begins to increase with death and drying, starting from the base of the frond towards its top. As for *Figure 3*, the yellowing begins from the top of the leaflet back to its base, and sometimes it is from the middle of the leaflet, with a random spread of yellowing here and there over parts of the leaflet. In *Figure 4*, we notice the presence of black spots on the leaves in a circular or elongated form, with complete dryness and stiffness of the entire leaf. We also notice the spread of some black spots on some of the frond leaves in a dense manner. As for *Figure 5*, we notice the presence of a large black bug that may take the shape of an oval surrounded by/or marked in light brown.



Figure 2. Yellowing of leaves at the site of infection.



Figure 3. Yellowing begins at the top of the leaf, the site of infection.



Figure 4. The presence of a large black bug.



Figure 5. There are black spots on the leaves, circular or elongated.

Evaluation of the efficiency of some fungicides in the growth of fungi that cause spot spot in vivo (in vitro)

Table 3 shows that there is a decrease in the growth of the fungi that cause spot diseases in palm trees with an increase in the concentration of the pesticide topsin. The results showed that the 0.1% concentration recommended by the production company did not lead to a complete inhibition of the growth of the pathogenic fungi, as the diameters of the fungal colonies reached *F. monilifrome* and *F. oxysporum* and *Aliternaia* sp, about 1.9, 1.55, and 4.1 cm, respectively, compared to the control treatment, where the diameters reached 6.1, 5.3, and 5.4 cm, respectively. When the concentration was increased to 0.2%, this led to a complete inhibition of the growth of the *F. monilifrome* and *F. oxysporum*, while the fungus *Aliternaria* sp showed high resistance in the presence of the pesticide topsin, as the average colony diameters reached 3.35 cm compared to 5.4 cm in the absence of the pesticide.

Table 3. Effect of different concentrations of the pesticide topsin on the growth of fungi that cause spot diseases in palm trees.

Pathogenic fungus	Comparison			
	0	0.05	0.1	0.2
<i>F. monilifrome</i>	6.1	2.15	1.9	0.0
<i>F. oxysporum</i>	5.3	2.3	1.55	0.0
<i>Alternaria</i> sp.	5.4	5.1	4.1	3.35

Note: The least significant difference 0.01.

The results explain that there is a direct proportionality to the growth of pathogenic fungi and the concentrations of the pesticide topsin, as the higher the concentration of the pesticide, the greater the inhibition of fungal growth. This may be attributed to the increase in the active substance that affects the plasma membranes and cell walls of the fungi and then leads to the inhibition of their growth. It is noted from the results that the recommended concentration By the pesticide production company Topsin, it did not lead to a complete inhibition of the growth of pathogenic fungi, and this may be due to the possibility of showing resistance to this pesticide, or to the fact that these fungal isolates are genetic compositions whose gene expression for metabolic activities differs, which showed a mutation that led to the pesticide being broken down by these fungi,

especially *Alternaria*. sp. which was the most resistant fungus to this pesticide (Kader and Hussein, 2009).

Table 4 shows that there is a decrease in the growth of the fungi that cause spot diseases in palm trees with an increase in the concentration of the pesticide Tashgarin. The results showed that the concentration of 1.15%, which is the concentration recommended by the company producing this pesticide, led to a complete inhibition of the growth of the pathogenic fungi *F. oxysporum* and *Alternaria* sp., while the fungus *F. monilifrome* showed resistance in the presence of the concentration of the pesticide tugarin recommended by the producing company, as the colony diameters of the fungus *F. monilifrome* reached 1.45 cm, compared to the control treatment, where the diameters reached 4.3 cm. When the concentration was increased to 0.3%, it lost This led to complete inhibition of the growth of *F. fungi. monilifrome* and *F. oxysporum* and *Alternaria* sp. compared to the control treatment, the diameters reached 4.3, 4.1, and 4.3 cm, respectively.

Table 4. Effect of different concentrations of the pesticide tasgarin on the growth of fungi that cause spot diseases in palm trees.

Pathogenic fungus	Comparison			
	0	0.15	0.75	0.3
<i>F. monilifrome</i>	4.3	1.45	1.8	0
<i>F. oxysporum</i>	4.1	0	1.2	0
<i>Alternaria</i> sp.	4.3	0	1.65	0

Note: The least significant difference 0.01.

It is noted from the results that there is complete inhibition of fungal growth through the pesticide concentration recommended by the pesticide production company Tashgarin for the fungi *Alternaria* sp and *F. oxysporum*, while the fungus *F. moniliforme*, and this may be attributed to the high effectiveness of this pesticide in inhibiting the growth of fungi, as well as being a plant growth enhancer. When the concentration of the pesticide tasgarin was increased, this led to a complete inhibition of the growth of fungi, and this may be due to an increase in the active substance that affects the plasma membranes and cell walls of the fungi, and then leads to To inhibit its growth, especially on the fungus *F. monilifrome*, which showed resistance at the concentration recommended by the pesticide production company (Naderi and Abedi, 2012).

Evaluation of the effectiveness of the pesticides topsinand tashgarin on all fungi that cause spot disease using palm leaves (in vivo)

Figure 6 shows that the highest rate of inhibition of fungal growth on palm leaves (Khastawy variety) was 100% for both *F. fungi. moniliforme* and *F. oxysporum* at a concentration of 0.2%, while this concentration did not inhibit the fungus *Alternaria* sp. Completely, as the inhibition rate reached 91.4%, and the concentration of 0.1%, which is the concentration recommended by the company producing this pesticide, did not achieve stable inhibition of all pathogenic fungi if the inhibition rate reached 77, 85, 86.2% for the fungi *Alternaria* sp. *F. oxysporum* and *F. moniliforme*, respectively. The results also show that the lowest percentage of inhibition was at a concentration of 50% of the recommended concentration. It is also noted that in the absence of the pesticide (control), we did not obtain 100% complete infections, as the inhibition rate reached

11.3, 11.5, and 14.6% for the fungi *Alternaria sp.* *F. oxysporum* and *F. moniliforme* respectively

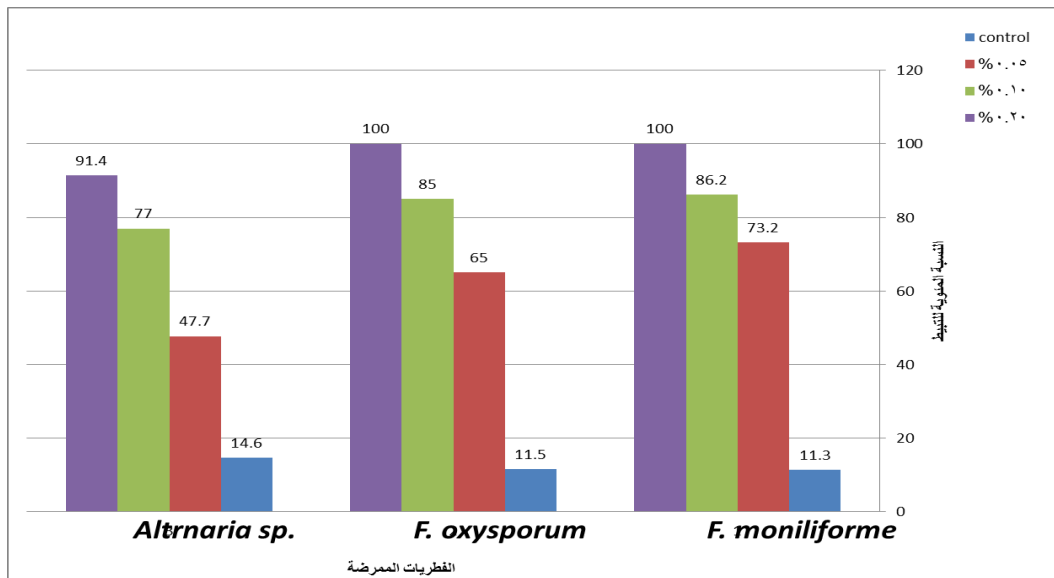


Figure 6. Evaluation of the effectiveness of different concentrations of the pesticide topsin on fungi that cause leaf spot diseases using palm leaves of the Khastawi variety (In vivo).

The failure to inhibit the growth of pathogenic fungi by the recommended concentration of the pesticide production company Topsin may be due to the fact that these local isolates of fungi have genetic structures that differ from other isolates of fungi tested by the pesticide production company, or the reason may be due to the development of resistance to the pesticide Topsin. By these fungi, especially *Alternaria spp.* Which resisted the pesticide even at double the concentration, which indicates the high resistance of this fungus to the pesticide topsin. As for *Figure 7*, the highest percentage of inhibition on leaves of the palm variety (Khastawi) was 100% at concentrations of 0.15 and 0.3% for both *Alternaria spp.* And *F. oxysporum*, while these concentrations did not inhibit the fungus *F. moniliforme* completely, as the inhibition rate reached 34% at a concentration of 0.15%, which is the concentration recommended by the pesticide production company, while the inhibition rate reached 36.8% at a concentration of The concentration of 0.75% did not completely inhibit the growth of the same *F* fungus. *moniliforme*, if the inhibition rate reached 31% compared to the control treatment, 11.3%, while the concentration of 0.75 completely inhibited the growth of both *Alternaria spp.* And *F. oxysporum* if the inhibition rate reached 100%. It is also noted from the results that the lowest inhibition rate for the fungus *F. moniliforme* was at a concentration of 0.75% if the inhibition rate reached 31.3%. It is also noted that in the absence of the pesticide (control), we did not obtain 100% complete infections, as the inhibition rate reached 11.3, 11.5, and 14.6% for the fungi *Alternaria sp.* and *F.oxysporum*, *F. moniliforme* 0.3% respectively (Alaa, 2005; Akhtar et al., 2004).

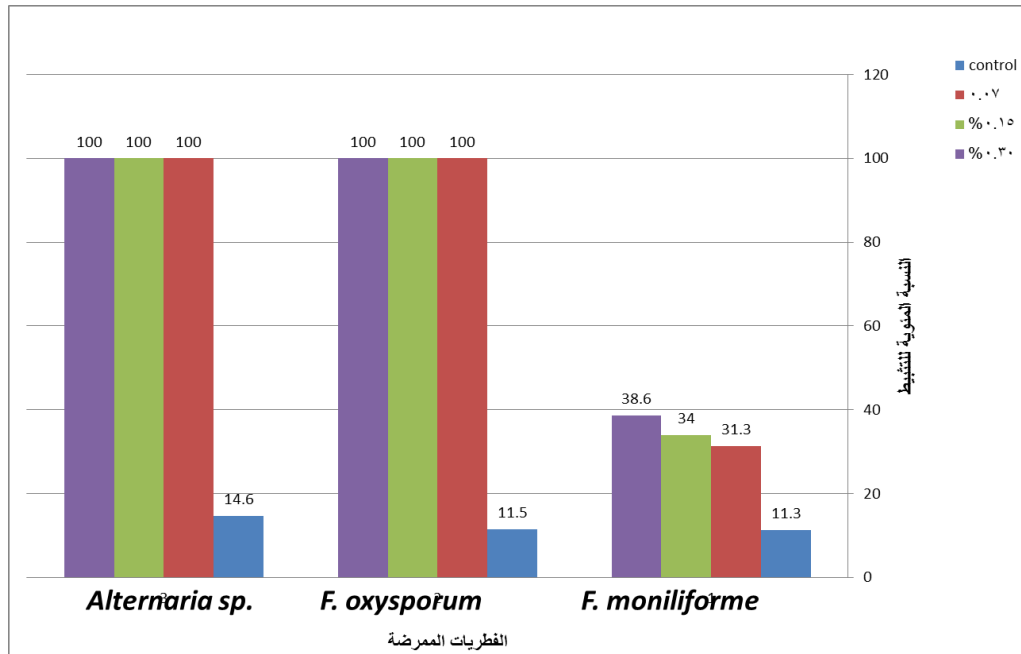


Figure 7. Evaluating the effectiveness of different concentrations of the pesticide tegarín on the fungi that cause spot diseases using palm leaves of the Khastawi variety (In vivo).

The lack of growth inhibition of the pathogenic fungus *F. moniliforme* by the concentration recommended by the pesticide production company Tigarín. This may be due to the fact that these local isolates of the fungus have genetic structures that differ from other isolates of fungi tested by the pesticide production company, or perhaps the reason is due to the development of resistance to the pesticide Tigarín by these fungi. While complete inhibition of the growth of *Alternaria spp.*, *F. oxysporum* at the concentration recommended by the pesticide production company Tashgarín may be attributed to the active ingredient affecting the plasma membranes and cell walls of the fungi and then leading to the inhibition of their growth (Ati and Abass, 2010; Oostendorp et al., 2001).

Conclusion

In conclusion, all palm trees in the colleges of Tikrit University/Iraq are free from brown spot disease. Laboratory results proved that the pesticide Tigarín is more effective than the pesticide Topsin when used against pathogens of brown spot disease. In recommendations, spraying palm trees in the colleges of Tikrit University/Iraq with the pesticide Tigarín due to its high efficiency against the causative agents of brown spot disease. Paying attention to irrigation and all agricultural operations of palm trees. Spraying palm trees with insecticides in addition to fungicides, specifically tashgarín pesticide.

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Conflict of interest

The authors confirm that there is no conflict of interest involve with any parties in this research study.

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