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EFFICIENCY EVALUATION OF SOME ENTOMOPATHOGENIC FUNGI ON DUST MITE *OLIGONYCHUS AFRASIATICUS* (MCGREGOR) (ACARI: TETRANYCHIDAE)

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Abstract

The entomopathogenic fungi *Beauveria bassiana*, *Metarhizium acridum*, *Lecanicillium muscarium* and *Isaria fumosorosea* were used with concentrations of 2, 3, 4, 5 gm.L^{-1} to control dust mite in the laboratory at 30 ± 1ºC and relative humidity of 40 ± 5%. the results showed that the mortality percent achieved by these pathogenic fungi were positively correlated with the used concentrations. and its effect on the pest eggs was lower than on its adults. The efficacy of these pathogens on eggs mortality were 30, 36.7, 41 and 57% at concentration of 5 gm.L^{-1} in fungi of *I. fumosorosea, B. bassiana, L. muscarium* and *M. acridum* respectively, While the mortality percent of adult females were 73.3, 88, 92 and 92%, respectively, after seven days of treatment.

Key words: *Oligonychus afrasiaticus* , Ghobar Mite , Entomopathogenic fungi

Introduction

The dust mite *O. afrasiaticus* (McGregor) (Acari: Tetranychidae) is one of the major pests affecting the date palm trees with lesser date moth (*Batrachedra amydraula* Meyrick) and Dubas bug (*Ommatissus binotatus* lybicus Bergevin). Which is called locally in Iraq (Ghobar mite) and it is one of the most damaging pests on palm trees in recent years in Iraq. The damage arises as a result of active stages of mite, such as the larvae, the first and second stages of nymph and adults which are Feeding by sucking the sap from the fruit tissue (chimri and Khalal). So the fruits appear dark reddish, especially in the area near the perianth (Al-Jboori, 1999; Mohamed, 2005). The most harmful effect on the fruits is the secretion of this type of mite a dense web on fruits and bunches, which causes the accumulation of large amounts of dust and the remains of transformation process and dead mite. This dust obstructs the physiological processes of the fruit in addition to the impact of its shade on the fruit, which causes delayed coloration and maturity. Infected fruits are not suitable for human consumption. They can be used as animal feed or left on palm trees, which may exacerbate the problem in subsequent years (Hussain, 1974 ; Al- Jboori, 1999).

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The widespread use of chemical pesticides has affected the ecosystem through bioaccumulation of pesticides in the food chain, in addition to the mite resistance, which in turn increased the concentration of the chemical substances, which exacerbated the problem, and the most severe damage is the impact on the natural enemies of the mite, which leads to disruption of the natural balance, and the loss of this balance means the use of pesticides (Al-Dahwi *et al.*, 2009; Al-Dahwi *et al.*, 2012 ; Subash, 2010; Shamika, 2017). These reasons led to thinking about the search for alternative means of control, so the use of pathogenic fungi as biological control agents the dust mite *O. afrasiaticus*.

Materials and methods

Mite colony breeding in laboratory:

The dust mite was collected from the infected palm trees of the Alrabeaa station dedicated to economic cultivars breeding that belonging to the department of horticulture - Ministry of Agriculture which located in the area of Zaafaraniya - southern Baghdad and transferred to the breeding room using the seedlings of *Washingtonia filifera* palms at the age of 3 weeks, temperature of 30 ± 2ºC and humidity of 60 ± 5 in order to reproduction and taking the required numbers for laboratory experiments.

Sources of entomopathogenic fungi isolates:

The pathogenic fungal isolates of *Beauveria bassiana*, *Metarhizium acridum* (*Metarhizium anisopliae* var. *acridum*), *Lecanicillium muscarium* (Petch) Zare & W. Gams(*Verticillium lecanii*), *Isaria fumosorosea* (*Paecilomyces fumosorosea* (Wize))(Trissi *et al.*, 2018) Obtained from the Laboratory of fungal diseases office of plant protection - Ministry of Agriculture. which is dry produced from local isolates of these fungal species.

Effect of pathogenic fungi on eggs:

Several mite adult females were transferred to the *Washingtonia* seedlings (The crown area of seedling was surrounded by vaseline to prevent the escape of mite) 18 hours were left, adults were removed and 10 eggs per seedling were left, The study included three replicates for each treatment and the experiment was repeated three times. While the control treatment was without spraying, The biological agents were sprayed with a hand sprayer using 0.5 ml per replicate with concentrations of 2, 3, 4, 5 gm.L^{-1} from each pathogenic species used in the experiment, mortality rates were calculated based on the number of non-hatching eggs after four days of treatments conducted when all eggs were hatched in control treatment. (Kongchuensin and Takafuji, 2005; Negash *et al.*, 2014; Seiedy and Moezipour, 2017).

The effect of pathogenic fungi on adult females:

Twenty adult females were Transferred to the *Washingtonia* seedlings at the age of three weeks using brush with one hair and then it was left for 4 hours to ensure females safety (The crown area of seedling was surrounded by vaseline in order to prevent females escape), Three replicates for each treatment were used and the experiment was repeated three times. While the control treatment was without spraying, The biological agents were sprayed with a hand sprayer using 0.5 ml per replicate with concentrations of 2, 3, 4, 5 gm.L^{-1} from each pathogenic species used in the experiment (Bouamama, 2010; Roza *et al*., 2014; Mahdi *et al*., 2017), Number of adult females counted at 3 and 7 days after the treatment, mortality rates of adult females were corrected according to Abbott (1925).

All experiments were conducted at constant laboratory conditions (temperature 30 ± 1°C, R.H. %40 ± 5, duration of light: darkness 16 : 8.

Statistical analysis

The laboratory experiment was designed according to the complete randomized design (CRD). The data were statistically analyzed using the analysis of variance method. The least significant difference LSD was used for at the level of 0.05 probability to compare the means, Genstat v.12.1 software was used in the statistical analysis (Al-Rawi and Khalaf Allah, 2000).

Results and discussion

Effect of pathogenic fungi on eggs:

After spraying the pathogenic fungi on the seedlings of *Washingtonia*, the effect on the eggs of the dust mite is appears through the change in the color of the infected eggs to a light orange color and then a dark orange and then to the brown color. After that, shrinkage and wrinkling of the eggs are observed. the Fig. 1 shows the efficiency of the fungal pathogens used in the inhibition of dust mite eggs *O. afrasiaticus* after four days of treatment, which is the period in which all eggs hatched in control treatment. It is noted the superiority of the pathogen *M. acridum* which was superior compared to the other fungi with significant differences, the relative efficiency rate reached 25% followed by *L. muscarium* that gave 19.4%, while the lowest efficiency obtained from the pathogens of *B. bassiana* and *I. fumosorose*, which have rates of eggs inhibition reached 14.1 and 13.4%, respectively. The results also showed that there was a difference between the inhibition rates achieved within the same fungus depending on the used concentration which are positively correlated with the used concentrations. The lowest rate reached 3.3% obtained from the concentration of 2 gm.L^{-1} for all pathogenic fungi. The highest eggs inhibition rate was 57, 41, 36.7 and 30% obtained from M. acridum, L. muscarium, B. bassiana and I. fumosorose, respectively, at a concentration of 5 gm.L^{-1}.

Gouli *et al*., (2005) showed that the fungi which cause mite diseases such as *I. fumosorose, L. muscarium, B. bassiana and M. acridum* are often able to infect many stages of the growth of their hosts, including eggs.

Eilenberg *et al*., (2001) also indicated that

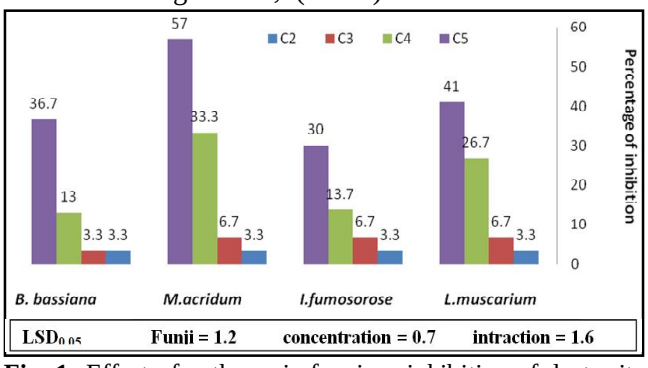

Fig. 1: Effect of pathogenic fungi on inhibition of dust mite eggs at 30 ± 1 ° C and relative humidity 5 ± 40%.

Table 1: Effect of pathogenic fungi on Dust mite adults at 30 ± 1°C and relative humidity of 40.5%.

Treatment	Conc. g /L	Corrected percentage of mortality of Adult females		Average
		3 days later	7 days later	
		Average	Average	
B. bassiana	2	3.0	12.3	7.65
	3	12.0	14.0	13.0
	4	15.0	22.3	18.65
	5	60.0	88	74.0
Average		22.5	34.15	28.33
M. acridum	2	21.33	26.0	23.65
	3	21.33	30.33	25.83
	4	27.3	40.3	33.80
	5	68.7	92.0	80.35
Average		34.67	47.15	40.9
I. fumosorose	2	2.3	4.66	3.35
	3	15.3	17.0	16.15
	4	17.3	22.3	19.8
	5	55.3	73.3	64.3

pathogenic fungi can be used in several ways in the biological control such as immerse plants with pathogenic fungus. Roza *et al.* (2014) showed that the activity of *B. bassiana* on mite eggs *T. urtica* in greenhouses at a temperature range of 25, 30°C was 61% while it was 76% for *M. acridum.*

Effect of pathogenic fungi on adult females:

The efficiency of the used fungal pathogens in influence on dust mite adults *O. afrasiaticus* during different periods of time. Observing through the general rate of efficiency of these biological agents with their different treatments on adult of pest shows the superiority of *M. acridum* compared to other pathogens with significant differences that gave relative efficiency reached 40.9%, followed by *L. muscarium* by 34.24%, and then *B. bassiana* and *I. fumosorose*, respectively by 28.33 and 25.9% (Table 1). The results also showed that there is a significant difference between mortality rates achieved within the same fungus depending on the used concentration which are positively correlated with the used concentrations of all fungal pathogens. The lowest relative efficiency was 3.35, 6.15, 7.65 and 23.65% for the fungi *I. fumosorose, L. muscarium, B. bassiana and M. acridum*, respectively, at a concentration of 2 gm.L^{-1}, while the highest relative efficiency of these fungi reached 64.3, 86.5, 74.0 and 80.35%, respectively.

In terms of the time duration on the efficiency of different fungi, all of it affected after three days of treatment with the superiority of *L. muscarium* followed by *M. Acridum* and then *B. bassiana* while fungus *I. fumosorose* gave the lowest value of relative efficiency reached 81, 68.7, 60% and 55.3, respectively, with significant differences at a concentration of 5 gm.L^{-1}. While after seven days of treatment, the fungal pathogens of *L. muscarium* and *M. acridum* were superiors by giving the highest percent of relative efficiency reached 92% with significant differences followed by *B. bassiana* that gave relative efficiency reached 88%. While the lowest relative efficiency obtained from *I. fumosorose* and reached 73.3% at a concentration of 5 gm.L^{-1}. While at the concentration of 2 gm.L^{-1} after seven days of treatment, the efficiency of these fungal pathogens reached 6.5, 23.65, 7.65 and 3.35%, respectively.

The results indicated that the ability of these pathogenic fungi to exterminate the adults of dust mite. The lowest fungi activity was at 2 gm.L^{-1} and the highest fungi activity was at 5 gm.L^{-1} after 3 and 7 days with significant differences between the concentrations as shown in the table 1 also noted from the table results, there is a significant difference in the effectiveness of these pathogens with different concentrations after 3 and 7 days of treatment, where the highest activity of these pathogens was at 5 gm.L^{-1} followed by 4 gm.L^{-1} with significant difference compared to other concentrations. This indicates that the concentration of 5 gm.L^{-1} is the appropriate concentration to use these pathogens to control the dust mite pest. It was also observed by observing the mite individuals after the treatment that the affected individuals decrease their movement and become slow and then stop the movement completely and then shrink and become dark brown. It is also an important observation that can be extrapolated from Table 1. The difference in the effectiveness of these nurses at 3 and 7 days after treatment is significantly lower than the variation in effectiveness of the difference of concentration. In this regard, Seiedy and Moezipour (2017) indicated that the effect of pathogenic fungus on adult dust mite appears early after three day of treatment and the effect is manifested by shrinking the mite and turned dark color.

The results of the study showed that the pathogens of *M. acridum and L. muscarium* can be adopted as effective biological control agents in neutralizing the dust mite pest on date palm trees.

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