

# Evaluation the efficiency of pathogenic fungi *Paecilomyces fumosoroseus* in protection the wood and Olive trees against infestation of termite *Microcerotermes diversus* (Silv.) in Iraq.

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**ABSTRACT:** The Study was conducted to evaluate the different concentrations of pathogenic fungi *Paecilomyces fumosoroseus* in protection wood and Olive trees against infestation of termite *M. diversus* by using termite bait stations during 2015. The results showed that the fungi *P. fumosoroseus* caused high efficiency in protection of treated wood in termite bait station and the efficiency increased due to the increasing of the concentration of fungi which the high concentration 10gm/L caused high reducing in percentage losses of wood weight, while the lowest concentration of fungi 2.5gm/L was vice versa. The result of study found a positive correlation between the fungi concentration in treated wood inside bait stations and number of visitor workers and percentage losses in weight wood. Also it proves that the presence of termite bait stations around the Olive trees that contains wood treated with different concentration of fungi attract termites worker from the stem of Olive tree. The concentration of fungi 5gm/L was the most efficient concentration in protection the trees against termite infestation as its effect was clear in tunnel building process and number of attracted termites worker, and prevent the infestation on stem trees for 4 month after treatment, while concentration 2.5gm/L less efficiency on which record one month protection of stem trees in spite of the reinfestation occurred after two months with clear decrement in number of termites worker, infestation was dismissed in the forth month. The concentration 10gm/L in termite stations show no efficiency in protection of stem trees against termite infestation compared with another concentrations and control treatment.

## INTRODUCTION

The termites were considered among the most important economic insects, some species of termites live below the soil surface and at several depths may be difficult in some cases to get it(1), the losses caused by termites in the United States is estimated at 11 billion dollars annually and 80% of which is spent on chemical control (9). The termite *Microcerotermes diversus* (Silv.) was the most economic insect in all regions of Iraq that causing heavy economic losses in fruit trees and field crop plants(2). Because of the problems recorder by Termicides used in termite control many research conducted safety method alternatives and Global Environment protection Organization EPA reconsidered the irrational use of termicides because of the risk to human health and proceeded to promote the use of alternatives of pesticides chemical safe human health and environment(4). The biological control offers methods more permanent to control insects, especially insect termite and with minimal damage to the environment(8), the pathogenic fungi used to protect wood from infestation of termites and can be used in several ways to control termites such as direct spraying on nests termites and places of termite infestation appear, in addition to using pathogenic fungi in termite bait stations that the spores of fungi will be carried by worker to nest and move to other healthy individuals(14). The fungi *Paecilomyces fumosoroseus* (Mize) Brown & Smith is a good candidate for microbial control which used to control insects, especially termites attack the economic crops (15), the fungi *P. fumosoroseus* used to control termites in field and fungus had high ability to the spread between the individuals of the termites and nest conditions of subterranean termites from moisture and darkness was a favorite and suitable for the growth of fungus(8), that the fungi *P. fumosoroseus* was useful in protecting living trees, plants, timber and forest and other cellulose materials against termites infestation(7), several researchs was conducted to control termites through the application of baits system, as Esenther et al (6) suggested using wood cutting in the system bait stations which considered one of important strategies in the termite control in

addition to decreased the environmental affect, the possibility of protection in the long term and use within the IPM programs since 1994 to protect homes from termites infestation and control so that the products of bait stations accounted for 30% in the markets(11).

Due to the economic importance of termites in Iraq and searching for safty method to control the study aimed to evaluate the efficacy of different concentrations of the fungus *Paecilomyces fumosoroseus* to protect the wood and Olive trees from the injury plague termite bait station .

## MATERIALS AND METHODS

### ***Evaluate the efficiency of different concentrations of the fungus *Paecilomyces fumosoroseus* to protect wood from injury termite insect by using Termite bait station***

Select five Olive trees infested with high infestation of termites *Microcerotermes diversus*(Silv.),in an Olive grove in the Faculty of Engineering and Burrow three pits equal to the size and dimensions of station area around the trunk of each tree(12),attended the 15 bait stations private for termites where station that tray plastic cylindrical in shape with a lide 16 cm diameter length of 6.5cm,doing two holes opposite length of 8 cm and a width 4 cm and four opposite openings length of 8 cm and awidth of 1cm and four diameter circular holes 0.5 cm in plastic enclosure base to enable individuals of the termites from entering the station .The wood which used in termites bait station was Palm Sunday fronds which preferred by the termite(2).

For the purpose of the treatment by fungi attended 15 packages of Palm Sunday fronds,and dried by an electric oven at a temperature of 120 °c for a period of 48 hours,and then strengthened with adhesive tape and weighted Palm Sunday fronds packages by a sensitive balance recorded weights before treatment , and for the purpose of treatment packages timber was attended by five large plastic containers that can accommodate three packages represent three replicates per treatment that included the concentrations fungus *P.fumosoroseus* (2.5,5,10)g/L and the control treatment (water only)and termicide (Bifenthrin)Aquastar concentration of 5 ml/L and put in each pot 2 liters of each treatment solution , and left all packages in solution for 24 hours so as to ensure the absorption of the solution and uniformly distributed on the timber .After the completion of the treatment of all the packages have been raising non-treatment packages after making sure infestation in all stations with termite,and replaced packages treatment ,the treatment was distributed to the trees at random .The stations closed in its cover and examined monthly and record the existence of infestation of termite.For the purpose of studying the effect of bait stations set up around the Olive trees to attract the termite worker and its effect on the infestation Olive trees with monthly examined was conducted to determine the constraction of new tennule on the stem of trees and calculate the number of termite workers in the tunnel with length 20 cm if there presence in all treatment.The study lasted for five months from 2/7/2015 until 2/12/2015,and after the end of the experiment raised the wood packages and calculated the number of individuals termites inside each packages and washed packages from the soil particales and dried in an electric oven at a temperature of 120 °C for a period of 12 hours and then weighed and calculated the percentages of weight loss based on timber weight befor treatment and weight after the completion of the experiment.

The results statistically analyzed according to the RCBD design and the results were compared using L.S.D 5% and used the statistical software SAS(2012) to analyze the results.

## RESULT AND DISCUSSION

### ***Effect of different concentration of fungi *Paecilomyces fumosoroseus* in protection of wood against termite infestation***

Results showed that were adference in the percentages of weight losses of wood which treated in different concentrations of fungi *P.fumosoroseus* which caused least losses ,where the superiority of the high concentration 10gm/L compared whith another concentration and the control treatment,while the concentration 5gm/L caused highest losses percentage .The statical analysis proved significant variance in the weight losses between the treatment (Table 1)

Where the percentage of losses in the wood weight reached 45.39 ,49.38, 19.61 % at concentration 2.5,5 and 10 gm/L respectively while the losses in control treatment achieved 79.1% and the termicide Bifenthrin achieved 0% losses during the period of study .The result appeared that the fungus *P.fumosoroseus* proved high efficacy in protecting the wood in termite bait stations and the efficiency increased due to increasing the fungus concentration .In addition to the losses of weight wood the termite individuals were affected in different concentration of fungus treated the wood in the termite bait stations after 5 months of treatment.

Where the result in table (2) showed that the concentration 10gm/L record less the presence of individuals at the bait stations which reached 1331.00 individuals /station which differed significantly from concentrations 2.5 and 5 gm/L that records 5113.33,3162.66 individuals/station respectively ,while the control treatment recorded higher presence of termite individuals at the bait station that reached 6034.33 ,is clear from the above reselts that there was a clear correlation between the concentration of fungi in treated wood inside the stations and the number of worker visiting and the weight losses in wood where the low concentration record high number of workers and the highest percentage loss compared to the high concentration (10 gm/L), which record the lowest number of worker and least loss percentage in the wood that this link may be due to low concentration is characterized by the presence of a few spores of the fungus which reflected by slower in the killings of the worker termites attracting to wood baits in addition to the attraction of the worker to Palm Sunday fronds which considered a favorite wood to feed (2).While the low number of worker and the least losses percentage in wood in the termite bait stations treated with higher concentration of the fungus due to high numbers of spores of the fungus , which was attacked to the bodies of the worker and caused mortality as well as the high concentrations of the fungus causing repellency of termite individuals as established by some our experiences laboratory , In a similar study found Al-Marsoomy (3)that fronds in bait stations treated with IGR Nemsis with high concentration achieving the lowest rate percentage loss in weight compared to lowest concentrations and control treatment .

Table 1. Percentage of weight losses in the wood treated with different concentrations of fungus *P.fumosozeus* after five month of treatment

Treatment	The percentage of weight loss(%)
Fungi conc 2.5gm/L	45.39
Fungi conc 5gm/L	49.38
Fungi conc 10gm/L	19.61
Control treatment(only water)	79.10
Termicides(Bifentherin)	0.00
5ml/L	
L.S.D(P<0.05)	*8.37

Table 2 :number of termite individuals (Worker and Soldiers)in termite bait stations treated with different concentrations of the fungus *p.fumosozeus* after five months of treatment

Treatment	Number of Soldiers(Soldier/station)	Number of worker(worker/station)	Total number of individuals per station
Fungi con 2.5gm/L	7.33	5106	5113.33
Fungi con5gm/L	16.66	3146	3162.66
Fungi con10gm/L	10.00	1321	1331.00
Control treat(only water)	10.33	6024	6034.33
Termicide(Bifenthrin)	0	0	0
L.S.D(P<0.05)	*3.952	*1267.44	*1274.61

In a similar study Stoytchera(12) pointed that the occurrence of variation in Soldiers numbers means that the worker take more than the critical dose and become unable to maintain the health of their colonies and as a result may have occurred a quick collapse of the colony.

**The effect of different concentrations of the fungus *P.fumosozeus* in the stations on the infestation Olive trees with termite**

The results of study was proved that the presence of bait stations contain wood treated with different concentrations of the fungus around the Olive trees caused by the withdrawal of the worker from infested trees and infest the wood treated with fungus and that there were differences in the effect of different concentrations of the fungus in the bait station which depending on the fungus concentration ,as shown in table (3) that the fungus concentration 5gm/Lwas the most effective in protecting Olive trees through its influence on the construction of tunnels,as well as in the number of the worker visiting where this concentrations was caused protecting the Olive trees against trmite infestation through no presence of termite workers and stopped the tunnel construction on stem of Olive trees after 5 months of treatment (Table 3).The Olive trees which surrounded with termite bait stations contain wood treated with higher concentration emerges from result in table (3) showed the concentration of new tunnel on the stem of the Olive trees for the study in addition to the existence of worker in this tunnules and this can be attributed to the repelent influence of higher concentration of fungus treated the wood in bait station causing the exclusion of worker termites for stations and attacking trees,thereby records concentration 5 gm/L higher efficiency in the protection of trees to its effects attraction .

Lenz (10) noted that active ingredient additives to baits system, whether IGR or pathogens or chemicals must be characterized with slow effect and not repellent for termite and that this provides the opportunity for the spread of fungi spores inside the colony and then influence in the composition of the colony which leads to weaken and thus eliminated. Stoytchera (12) showed that a large number of worker termites exposed to the slow effect food, such as fungi or insect growth regulators at a certain concentration and carry it to colony center.

Table 3. tunnel lengths and number of worker termites on the Olive trees surrounded by termite bait station treated with different concentrations of the fungus *Paecilomyces fumosoroseus* after various time periods of treatment

Treatment	Tunnule length(cm)						
	(_)number of termite worker/20Cm tunule	Berore treatment	After month	After 2 months	After 3 month	After 4 month	After 5month
Fungi con 2.5gm/L	20 (3)	0.0 (0)	20 (5)	20 (2)	0.0 (0)	0.0 (0)	0.0 (0)
Fungi conc 5gm/L	20 (1)	0.0 (0)	0.0 (0)	7.6 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Fungi conc 10gm/L	20 (4)	20 (1)	20 (1)	20 (5)	20 (0)	20 (0)	20 (9)
Control treatment (only water)	20 (16)	20 (1)	10 (0)	7 (2)	0.0 (0)	0.0 (0)	0.0 (0)
Termiticide (Bifenthrin)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
L.S.D for tunnule length (P<0.05)	NS 0.00 *4.39	*4.29 NS 1.00	*5.07 *2.07	*4.38 *2.66	*4.25 NS 0.00	*4.25 NS 0.00	*4.25 *2.41
L.S.D for number of worker (P<0.05)							

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