

Effect of *Verticillium lecanii* on Date Palm Dubas bug (*Ommatisscus lybicus* Ashe & Wilson) 'In vitro'

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Abstract

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Date palm (*Phoenix dactylifera* L.) is an important fruit tree and cash crop in the Sultanate of Oman. At present dubas bug (*Ommatisscus lybicus* Ashe & Wilson) is a serious pest on date palms and it is controlled by aerial and ground spraying of chemical insecticides. Biological control may be a viable and safe way to manage this pest. The biofungicide Mycotol® (*Verticillium lecanii*) used for greenhouse whitefly (*Bemisia tabaci* Gennadius) control was tested against dubas bug under controlled conditions. Nymphs and adults of dubas bugs were released on date palm seedlings sprayed with the bioagent. Results revealed that *Verticillium lecanii* (Zimm.) Vieggas was more effective against nymphs than adult. It was also observed that with advancement of time the percent of mortality increased gradually both in the nymphs and adults.

Key words: Biological control, dubas bug, entomogenous fungi, *Ommatisscus lybicus*, *Phoenix dactylifera*, *Verticillium lecanii*.

Introduction

Date palm (*Phoenix dactylifera* L. Family: Arecaceae; sub family: Poaceae) is the most important cash and fruit tree grown in the Sultanate of Oman and the area under date palm is nearly 60% of the total cultivated area (3). There are several economically important pests attacking date palms (1). Of these, dubas bug (*Ommatisscus lybicus* Ashe & Wilson,; Homoptera, Tropiduchidae) is the most serious insect pest throughout the Sultanate. This is also an important pest of date palms in North Africa and the Near East (7, 14). It is a perennial problem on date palms. Dubas bug is a sucking insect and the palms are affected directly by the sap feeding nymphs and adults. Indirectly the palms are affected by the huge amount of honeydew secreted by the insects.

At present, dubas bug is controlled by aerial and surface spraying of chemical insecticides. The Ministry of Agriculture and Fisheries in the Sultanate has conducted aerial and ground spraying of chemical insecticides against this pest for more than 20 years (2) and the pest resurgence has been observed in several locations. Continuing usage of pesticides has caused rapid development of resistance in some pest species and resulted in subsequent outbreak of the insects due to the deleterious effect on of its natural enemies.

Biological control is seen as an alternative and safer way to control this devastating insect. Several entomogenous fungi such as *Beauveria bassiana*, *Metarhizium anisopliae*, *Paecilomyces* spp. and *Verticillium lecanii* are used to control several insect pests (6, 18, 22, 23, 25). The pathogenicity and effect of *Verticillium lecanii* as a biofungicide has been successfully tested on whiteflies, aphids and thrips (4, 9,13).

Several commercial biofungicides containing *Verticillium lecanii* as active ingredient have been tested against various sucking insects infesting cucumber and tomatoes (12, 19). Therefore laboratory studies were conducted to assess the potential of a commercial product Mycotol® containing *Verticillium lecanii* for control of dubas bug on date palm. This product is recommended for whiteflies (*Bemisia tabaci*) in greenhouse at 1g/liter of water. Using of *Verticillium lecanii* for management of dubas bug has not been reported previously.

Materials and methods

Mycotol® (*Verticillium lecanii*) a commercial bio fungicide, produced by Koppert, Netherlands was tested against dubas bug under laboratory conditions. The concentration of fungal conidia in this product was 16.1 % active ingredient.

Nymphs and adult dubas bug were collected from date palm trees in insect collecting potters and brought to the plant pathology laboratory of Jimah Agricultural Research Station in the Sultanate of Oman. Mycotol was mixed with water along with a sticking agent (Tepol @ 0.25 ml/lit of spray fluid) and sprayed using a hand mist sprayer of 1 liter capacity, at three different concentrations on date palm seedlings at the two leaf stage, 20 to 30 cm long, raised in pots (diameter 10 cm). Twenty nymphs and twenty adults of dubas bug were released on each plant. The plants were covered with ventilated plastic cages to prevent the insects from escaping. Control plants were sprayed only with sticker and water and handled as described for the treated plants, and all plants were kept under laboratory conditions. The average temperature was 22±2 °C and the relative humidity ranged from 45 to 55% inside the cages, where the insects were observed daily for any abnormality in behavior and for mortality. The experiment was repeated twice. RCBD statistical design was followed and the observations were analyzed statistically by two way analysis of variance (ANOVA).

Results and discussions

Several doses of Mycotol® (*Verticillium lecanii*) were tested for their efficacy against nymphal and adult stages of dubas bug. It was observed that insects in the treated plants remained motionless and sticking to the plants after 4 days. These are typical symptoms of fungus infected dead insects. They were carefully removed from the plants and observed under a stereo microscope. Whitish growth of fungal mycelium was observed on the joints of the insects and was later identified as *Verticillium lecanii*. The fungus covered the whole insects in 10 days. The mean data of two years of observations are recorded in Table 1.

The success in biocontrol depends on the penetration, infection and finally the mortality of insects. The earliest signs of infection were observed two days after inoculation,

where the insects were observed to be lethargic and staying in one place for a long time.

On the second day the percent mortality of nymphs was observed to be significant only at the highest dose of 2g/lit. The three doses used were found to be significantly effective on the 8th and 10th day after spraying. Generally, it was observed that with the advancement of time the percent mortality of nymphs increased in all three concentrations.

Yadav *et al.* (24) reported that *Metarhizium anisopliae* was more effective to early instars of white grubs (*Holotrichia consanguinea*). Hundred percent mortality was observed with *Beauveria bassiana* in both instar grubs. Gindin *et al.* (10) observed that several isolates of *Verticillium lecanii* showed high pathogenicity to all developmental stages of Silver white flies (*Bemisia argentifolii*). *Verticillium lecanii* was shown to confirm its effectiveness against different nymphal stages of *Trialeurodes vaporariorum* (West wood), including adults (5, 12, 15). Eggs were found to be immune to infection but the fungal hypha present on the eggs were found to infect the nymphs immediately after hatching.

James and Lighthart (16), tested many entomogenous fungi on the convergent lady beetle (*Hippodamia convergens*). They observed that the rate of mortality was dependent on the early instars and on the exposure concentrations.

When the effect of the bioagent was observed on the adult dubas bugs, it was noticed that there was no significant mortality on the 2nd day. It was found that the adult mortality increased significantly with the advancement of time. This is in agreement with Jeong *et al.* (17) findings. They reported the control of cotton aphid (*Aphis gossypii*) and green house white fly (*Trialeurodes vaporariorum*) using *Verticillium lecanii*. They observed that the time taken for LT₅₀ was from

2.74 to 3.31 days. They also reported that low concentrations gave relatively low mortality of aphids. They concluded that *Verticillium lecanii* was an effective biological agent against aphids and white flies and recommended high concentrations for effective control.

Sharma *et al.* (20) observed that the time required for 100 % mortality as well as median lethal time were prolonged progressively with the advancement of larval stages, irrespective of methods of inoculation and test insect species. Enhanced mortality with the increase in dose of inoculum was also observed. Vimala (21) findings were in accordance with this observation.

When isolates of *Beauveria bassiana* and *Verticillium lecanii* were bioassayed against aphids, Feng *et al.* (8), noticed that there was substantial difference in the mortality rate at different concentrations used.

Mortality of dubas bug in control treatments was due to natural conditions.

In this study, it was clear that *Verticillium lecanii* is effective on dubas bug and can be used for its control. Application of the bioagent at nymphal stages are more effective than later stages, but the concentrations of the bioagent and time of application plays a crucial role for an effective control. These experiments have to be further carried out in the fields under natural conditions.

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Table 1. Susceptibility of nymphs and adult dubas bug to *Verticillium lecanii*. Figures in parentheses are transformed angular values.

Dosage g/lit	No. of insects	mortality % (mean of two years)									
		period after inoculation (days)									
		2		4		6		8		10	
		Nymphs	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
0.5	20	1.25 (4.55)	0.00 (0.00)	6.25 (13.77)	0.00 (0.00)	20.00 (25.86)	0.00 (0.00)	21.25 (27.33)	5.63 (13.66)	48.75 (44.28)	28.13 (31.96)
1.0	20	2.50 (6.25)	0.00 (0.00)	11.25 (19.30)	1.88 (5.51)	48.75 (44.29)	4.38 (11.97)	74.38 (60.03)	30.63 (33.48)	92.50 (74.32)	29.38 (32.68)
2.0	20	5.63 (13.66)	1.88 (5.51)	53.75 (47.15)	23.13 (28.59)	76.25 (62.20)	48.13 (43.92)	95.63 (79.89)	70.00 (56.93)	100.00 (90.00)	71.88 (58.24)
0	20	0.63 (2.28)	0.63 (2.28)	1.88 (5.51)	1.88 (3.97)	6.88 (14.87)	3.13 (7.20)	6.25 (14.30)	5.63 (13.35)	8.13 (16.42)	6.25 (14.41)
LSD at 5%		8.59	6.00	7.17	9.30	13.19	7.50	9.30	7.22	3.33	8.08

المخلص

ليفنكستون، سام وخميس المافرجي. 2005. تأثير فطر *Verticillium lecanii* على حشرة الدوباس (*Ommatisscus lybicus* Ashe & Wilson) تحت الظروف المخبرية. مجلة وقاية النبات العربية. 23: 58-60.

يعد النخيل من أهم أشجار الفاكهة النقدية في سلطنة عمان، كما تعتبر حشرة الدوباس (*Ommatisscus lybicus* Ashe & Wilson) من أخطر الآفات التي تصيب النخيل في الوقت الحاضر، حيث يتم مكافحتها كيميائياً عن طريق الرش الجوي والأرضي. في هذه الدراسة تم تجربة المبيد الحيوي Mycotol الذي يحتوي على فطر *Verticillium lecanii* (Zimm.) Viegas كمادة فعالة لمقاومة الذبابة البيضاء *Bemisia tabaci* Gennadius على حشرة الدوباس تحت الظروف المخبرية. تم إطلاق عدد من الحوريات والحشرات الكاملة على إدارات نخيل تم رشها بالفطر. أظهرت النتائج أن تأثير الفطر *Verticillium lecanii* كان أعلى في طور الحوريات عنة في طور الحشرة الكاملة ولكن بمرور الوقت لوحظ ازدياد نسبة الموت في كلا الجيلين.

كلمات مفتاحية: مكافحة حيوية، حشرة الدوباس، *Ommatisscus lybicus*، *Phoenix dactylifera*، *Verticillium lecanii*
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