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EFFECT OF *Verticillium lecanii* ON *Spodoptera littoralis* (LEPIDOPTERA : NOCTUIDAE)

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ABSTRACT

Some responses were observed in the eggs and larvae of *Spodoptera littoralis* (Boisd.) under different concentrations of *V. lecanii*. The fungus proved virulent against the two stages of the insect. Treatment of the eggs appeared more susceptible to fungi than larvae. The treated eggs appeared a high reduced rate of hatchability and most of the hatched larvae from treated eggs failed to develop to adults and dead. LC_{50} for eggs was 1.15×10^7 spores/ml, and for larvae was 1.55×10^7 spores/ml. The obtained results from this work will be make it possible useful and promising potential of *V. lecanii* to be considered as a biocontrol agent against the *S. littoralis*.

INTRODUCTION

The Egyptian cotton leafworm, *Spodoptera littoralis* Boisd. (Lepidoptera : Noctuidae) is a serious pest of a wide range for economically important crops, especially cotton. Chemical control in the field faces serious difficulties because this insect developed resistance to most of common commercial pesticides, and the problems of toxic residues, contaminating the environment and adversely affecting the non-target organisms. Advantage consist in safety for human and other non-target organisms, reduction of pesticide residues in food, preservation of other natural enemies and increased biodiversity in managed ecosystems (Lacey *et al*., 2001).

V. lecanii is a saprophyte and is able to survive despite low or absent host populations. This enhances its persistence and survival. It is well suited for commercialization because it will grown on all conventional mycological media, making culturing simple (Hall, 1981). *V. lecanii* can be used with pesticides and natural enemies (Gardner *et al*., 1984; Harper & Huang, 1986). Non-Pathogenic to plants (Samson & Rombach, 1985) and humans (Burges, 1981; Eaton *et al*., 1986). It is tolerance for a range of environmental conditions and makes its registration easier than for a foreign organism. High level of field efficacy, low cost, easily mass produced and applied, compatible with other tactics, non-toxic to mammals, and minimal potential for development of pest resistance. The mode of action is based on the direct contact between spores and insects.

Verticillium lecanii is a well known pathogen of arthropods. The host range of the species is wide and includes homopteran insects as well as range of other arthropod groups.

The present study provides information on the pathogenicity of *V. lecanii* against various stages of *S. littoralis* under laboratory conditions.

MATERIALS AND METHODS

Tested insects :

Spodoptera littoralis was reared on the host plant castor oil leaves at laboratory. Adults were put in jars to lay eggs on the plant leaves at 25°C. the insects were treated with the suspensions of *V. lecanii* as the following stages : newly deposited eggs 1 day old, second instar larvae, new pupae, and adult stages.

Fungus and bioassay procedures :

The product Mycotal is based on the entomogenous fungus *Verticillium lecanii*. It showed very promising results for enhancing the efficacy of the fungus for control of whiteflies and thrips (Van der Pas *et al*., 1998). The stock solution was prepared by adding 1 g powder to 1 L water, and then 5 concentrations were prepared, *i.e.* 4.6 x 10^7, 2.3 x 10^7, 1.15 x 10^7, 0.575 x 10^7 and 0.2875 x 10^7 spores/ml) and control. The application was done by spraying the target stage with suspensions. During all the tests, a piece of moist cotton was put in the jars and Petri-dishes to keep the relative humidity at 100 % after applications. The treated stages were examined on day 1, 2, 3 and 4 after treatment. Newly emerged larvae from treated eggs were maintained in order to examine mortality during larval development. To determine the lethal concentration, LC_{50} concentrations were used (4.6 x10^7, 2.3 x 10^7, 1.15 x 10^7, 0.575 x 10^7 and 0.28 x 10^7 spores/ml). Four replicates were made for each treatment and all treatments were incubated at 25°C. Percentage mortality was assessed 48 hours after treatments.

RESULTS AND DISCUSSION

The results in Table (1) generally showed that eggs of *S. littoralis* was susceptible to the fungus. Most of the hatched larvae from the treated eggs became infected with the fungus and dead.

The possible high susceptibility appeared at higher concentra-tion than those at the lower concentration (Table 1 and Fig. 1). The fungus appeared clearly on the treated eggs after putting in 100 % moisture at 25°C, and this explains the phenomenon which was demonstrated in host insects by Rodrigue-Reudan and Fargus (1980), they suggested two ways for contamination of newly hatched larvae, first fungal germination on the chorion surface and penetration of the eggs integument before hatching; second, conidia on the eggs cutivle could be an infective inoculum for neonate larvae upon chorion, and this mostly happened in lepidopterous eggs.

Table (1) : Susceptibility of eggs of *Spodoptera littoralis* to *V. lecanii* at different concentrations.

Concentrations	No. of treated eggs	Hatching (%)	Larval mortality (%)	Correct Mortality (%)
2.3 x 10^7	74	20	80	78.0
1.15 x 10^7	68	33	67	65.3
0.575 x 10^7	72	54	46	4.9
0.2875 x 10^7	80	71	29	28.0
Control		98.75	2.5	0.0

Data in Table (2) indicated the susceptibility of the second-instar larvae of *S. littoralis* to *V. lecanii*. The fungus appeared clearly on the treatment dead larvae after putting in 100 % moisture at 25°C.

Table (2) : Susceptibility of second-instar larvae of *S. littoralis* to *V. lecanii* at different concentrations.

Concentrations	No. of treated larvae	Mortality (%)	Correct mortality (%)
4.6×10^7	50	73.5	70.5
2.3×10^7	50	61.5	59.0
1.15×10^7	50	44.0	42.5
0.575×10^7	50	26.0	25.0
Control	50	2.0	0.0

The LC_{50} value for eggs stage was 1.15×10^7 spores/ml (Fig. 1) and for larval stage it was 1.55×10^7 spores/ml (Fig. 2). Data in Table (3) demonstrated that the total mean mortality percentage was 52.75 %, 66.25 % and 90.25 % for larvae, pupae and adult, respectively. These data are in agreement with those obtained by several authors. Feng *et al.* (1985 & 1988), they used *Beauveria bassiana* against *Ostrinia nubilalis* (Lepidoptera). Aly and Rashad (1997) who proved the susceptibility of *Earias insulana* (Boisd.) eggs and larvae to the fungus *Metarhizium anisopliae.* Hassani *et al.* (1998) who studied the effect of different strains of entomopathogenic fungi against *S. littoralis* and *Helicoverpa armigera,* while Parker (1998) studied the infection of *V. lecanii* against some lepidopteran insects, as *Bombyx mori, Cossula cossus, Lymantria dispar, Ostrinia nubilalis, Adoxophyes orana* and *Cydia pomonella*.

Table (3) : The effect of *V. lecanii* on the development of the newly emerging larvae from the treated eggs.

Stages	Replicates				Total mean	Con-trol
	1	2	3	4		
Larval mortality (%)	55.0	57.0	49.0	50.0	52.75	0.0
Pupal mortality (%)	65.0	73.0	67.5	59.5	66.25	0.0
Adult mortality (%)	85.5	93.0	95.0	87.5	90.25	0.0

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تأثير فطر *Verticillium lecanii* على دودة ورق القطن

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لوحظت بعض التأثيرات على بيض ويرقات دودة ورق القطن عند تعرضها لتركيزات مختلفة من الفطر *Verticillium lecanii*. وقد أظهر الفطر كفاءة حيوية ضد كلأ من طورى الحشرة. و إتضح أن البيض كان أكثر حساسية للمعاملة بالفطر عن معاملة اليرقات، حيث تسببت معاملة اليرقات فى خفض معدل فقس البيض كما أن معظم اليرقات الفاقسة لم تكمل تطورها إلى الطور الكامل (الفراشات). وجد أن التركيز النصفى القاتل لـ 50 % بالنسبة للبيض 1.15×10^{7} جرثومة/مل ولليرقات 1.55×10^{7} جرثوم/مل. وقد اتضح من هذه الدراسة أنه من الممكن إستخدام هذا الفطر كمادة حيوية واعدة كأحد عوامل المقاومة الحيوية لدودة ورق القطن.