J. Agric. Sci. Mansoura Univ., 32 (10): 8685 - 8690, 2007

EFFECT OF *Verticillium lecanii* ON THE TWO COTTON BOLLWORMS, *Earias insulana* BOISD. AND *Pectinophora gossypiella* (SAUND.) (LEPIDOPTERA)

Azab, A. M. A.; A. M. Rashad and Safaa H. Aly
Plant Protection Research Inst., Agric. Res. Center, Dokki, Giza, Egypt

ABSTRACT

Laboratory bioassays of the fungus, *Verticillum lecanii* against different stages of the two cotton bollworms, *Earias insulana* Boisd. and *Pectinophora gossypiella* (Saund.) under different concentrations of fungus were studied. The fungus proved virulent efficacy against eggs and larvae of both pests treated eggs of both insect pests caused a reduction rate in the hatchability whereas eggs hatchability was reduced for both insect pests. It was evident that eggs and larvae of both insects were susceptible to fungal infection and most of hatched larvae from treated eggs failed to develop to adults and dead in both *E. insulana* and *P. gossypiella.* LC_{50} values against *E. insulana* eggs and larvae were $1.1X10^7$ spores/ml and $1.8X10^7$ spores/ml, respectively; whereas LC_{50} values against *P. gossypiella* eggs and larvae were $1X10^7$ spores/ml and $1.5X10^7$ spores/ml, respectively. Data clarified that *P. gossypiella* was more susceptible to the fungal than *E. insulana* through all the tested stages.

INTRODUCTION

Earias insulana Boisd. and *Pectinophora gossypiella* (Saund.) are the most important pests, which causing great damage to a lot of agricultural economic crops such as cotton, maize, okra….etc. many insect pathogens are employed as biological control agents to many insect pests in row and glasshouse crops, orchards, ornamentals, range, turf and lawn, stored products and forestry and for abatement of pest and vector insects of veterinary and medical importance. The microbial agents are safety to humans and other non-target organism moreover the microbial agents could reduce the insecticidal of pesticides residues in food contamination as well as keep the other natural enemies that are important element in the integrated pest management program (Lacey *et al.,* 2001).

Verticillum lecanii is a saprophyte and can to survive despite low or absent host populations. This enhances its persistence and survival. It is well suited for commercialization because it will grow on all conventional mycological media making culturing simple (Hall, 1981). *V. lecanii* could be integrated with pesticides and natural enemies (Harper & Huang 1980 and Gardner *et al.,* 1984). Non-pathogenic to plants (Samson & Rombach, 1985) and human (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.

Verticillum lecanii is a well pathogen of arthropods. The present work aims to study the effect of *Verticillum lecanii* on eggs and larvae of the two cotton bollworm, *E. insulana* and *P. gossypiella.*

MATERIAL AND METHODS

Host insects:

Eairs insulana and *Pectinophora gossypiella* were reared on artificial diet of beans at laboratory. Adults were put in jars to lay eggs on paper pieces at 25°C. Eggs one day old and newly hatched larvae were treated with the suspensions of the conidia.

The fungus and bioassay produces:

The product Mycotal is based on the entomogenous fungus, *Verticillium lecanii.* The stock solution was prepared by adding 1 gm powder to 1 liter of water; serial concentrations of the suspension were prepared as follows: $2.3X10^7$, $1.15X10^7$, $0.575X10^7$ **a**nd $0.2875X10^7$ spores/ml in addition to the untreated control. Four replicates were made for each concentration. The applications were implemented via spraying the eggs and the newly hatched larvae at Petri-dishes before eating. A piece of moist cotton was put in the Petri-dishes to keep the relative humidity at 100% after applications. All treatments were incubated at 25°C. The treated stages were examined at 1, 2, 3 and 4 days, after treatments. Newly hatched larvae from treated eggs were maintained in order to examine mortality rates during the larval developmental satge. All treatments were incubated at 25°C. Mortality percentages were assessed after 96 hours from the treatments.

RESULTS AND DISCUSSION

The present work indicates that the eggs and larvae of *E. insulana* and *P. gossypiella* exhibited susceptibility to the fungus, *V. lecanii.* Eggs appeared to be more susceptible than larvae of both insects. These results coincided with that obtained by Hassani *et al.* (1998), who studied the effect of different strains of entomopathogenic fungi against *S. littoralis* and *Helicoverpa armigera.*

Data represented in Table (1) show that the eggs of *E. insulana* were susceptible to the fungus as well as with the higher concentration than that obtained with lower one, the most of the hatched larvae emerged from the treated eggs were dead. LC_{50} value for eggs of *E. insulana* was $1.1X10^7$ spores/ml. Data cleared that high value gives 20.76 of hatching larvae, while low value gives 80% of hatching larvae. On the other hand high mortality occurred with high value (79.24%) than low one (20%) Table (1).

Susceptibility of *P. gossypiella* eggs to *V. lecanii:*

As shown in Table (2) data indicated that eggs of *P. gossypiella* were susceptible to fungus *V. lecanii* as well as the higher concentrations. Most of the larvae hatched from the treated eggs dead. Data in table (2) showed that high concentration ($2.3X10^7$) gives 8.6 times of mortality than low one ($0.2875X10^7$), on the other hand the low concentration gives 89.73 of hatching larvae, while high concentration gives 11.33% of hatching eggs.

These data are agreed with that finding by Hall (1982) who used *V. lecanii* against Lepidopteran insect, *Cydia pomonella.*

The data of both insects indicated that the eggs of *P. gossypiella* were more susceptible for the fungus than *E. insulana* eggs.

Susceptibility of *E. insulana* larvae to *V. lecanii:*

Data in Table (3) show that the larvae of *E. insulana* were susceptibility to the fungus and the higher susceptibility was appeared with higher concentrations, than that those at the lower concentrations. LC_{50} value for *E. insulana* larvae recorded $1.8X10^7$ spores/ml after 96 hours post-treatment with fungus. Whereas the high dose ($2.3X10^7$) gives (71.05%), ($0.2875X10^7$) gives 29.5% mortality of larvae (Table, 3).

Table (1): Susceptibility of eggs of *E. insulana* to different concentrations of *V. lecanii* after 96 hours after treatments.

Treatment Concentration	No. of treated eggs	Hatching (%)	Mortality (%)	Corrected mortality (%)
$2.3X10^7$	42.00	20.76	79.24	73.3
1.15X107	60.00	43.78	56.22	52.00
0.575X107	75.00	68.28	31.78	29.34
0.2875X107	36.00	80.00	20.00	18.50
Control	95.00	92.50	7.50	0.00

Table (2): Susceptibility of eggs of *P. gossypiella* to different concentrations of *V. lecanii* after 96 hours after treatments.

Treatment Concentration	No. of treated eggs	Hatching (%)	Mortality (%)	Corrected mortality (%)
$2.3X10^7$	56.00	11.33	88.67	80.00
1.15X107	47.67	38.82	61.18	55.20
0.575X107	53.00	65.32	34.69	31.29
0.2875X107	84.67	89.73	10.28	9.27
Control	127	90.22	9.78	0.00

Susceptibility of *P. gossypiella* larvae to *V. lecanii:*

Data in Table (4) indicated that the first larval instars of *P. gossypiella* were more susceptibility to the fungus and the high susceptibility was appeared with higher concentrations, than that happen with lower concentrations. LC_{50} value for the first larval instars of *P. gossypiella* was $1.5X10^7$ spores/ml after 96 hours from treatment with fungus. Whereas the high concentration gives 2.4 times of mortality than the low concentration (Table, 4).

These results are inagreement with Parker (1998) who used *V. lecanii* against Lepidopteran insects, *Bombyx mori, Cossula cossus, Lymantria dispar, Ostrinia nubilalis, Adoxophyes orana* and *Cydia pomonella.*

The effects of *V. lecanii* on the development rate of the newly emerged larvae from treated eggs of *E. insulana*:

As shown in Table (5) data demonstrated that the mortality percentages during the larval duration, pupal rate and the adult emergence percentages produced from the treated eggs were determined. Data revealed that the total larval mortality, scoring of pupation and the inhibition of the adult emergence were 32.5, 63.00, and 78%, respectively.

The effects of *V. lecanii* on the development rate of the different stages of *P. gossypiella* resulted from treated eggs:

Data illustrated in Table (6) demonstrated that the larval mortality percentages were 30.5%, the scoring of pupation exhibited 57.56 and the inhibition of the adult emergence recorded 72%.

The results of both insects indicated that *P. gossypiella* were more susceptible to the entmopathogen *V. lecanii* than *E. insulana*.

Table (3): Susceptibility of larval instars of *E. insulana* to different concentrations of *V. lecanii* after 96 hours after treatments.

Treatment / Concentration	No. of treated eggs	Mortality (%)	Corrected mortality (%)
$2.3X10^7$	40.00	71.05	67.50
1.15X107	40.00	58.00	55.10
0.575X107	40.00	43.68	41.50
0.2875X107	40.00	29.50	28.00
Control	40.00	2.00	0.00

Table (4): Susceptibility of larval instars of *P. gossypiella* to different concentrations of *V. lecanii* after 96 hours after treatments.

Treatment / Concentration	No. of treated eggs	Mortality (%)	Corrected mortality (%)
$2.3X10^7$	40.00	83.24	77.00
1.15X107	40.00	68.97	63.80
0.575X107	40.00	51.89	48.00
0.2875X107	40.00	34.38	31.80
Control	40.00	3.00	0.00

Table (5): The effect of *V. lecanii* on the development of the newly emerging larvae of *E. insulana* from the treated eggs.

Stage	Rep.				Corrected mortality (%)	Control
	1	2	3	4		
Larvae mortality %	30	40	35	25	32.5	0.0
Pupae mortality %	50	60	65	77	63	0.0
Adult mortality %	80	62	70	100	78	0.0

Table (6): The effect of *V. lecanii* on the development of the newly emerging larvae of *P. gossypiella* from the treated eggs.

Stage	Rep.				Corrected mortality (%)	Control
	1	2	3	4		
Larvae mortality %	30	20	42	30	30.5	0.0
Pupae mortality %	70	50	60	50	57.5	0.0
Adult mortality %	68	100	60	60	72.0	0.0

REFERENCES

Burges, H. D. (Ed.) (1981): Microbial control of pests and plant diseases 1970-1980. Academic Press, London.

Eaton, K. K.; T. J. Hennessy; D. J. Sondin and D. W. McNulty (1986): *Verticillum lecanii* allerogological and toxicological studies on work exposed personnel. Ann. Occup. Hyg., 30: 209-218.

Gardner, W. A.; R. D. Oetting and G. K. Storey (1984): Scheduling of *Verticillum lecanii* and benomyl applications tomaintain aphid (Homoptera:Aphididae) control on chrysanthemums in greenhouses. J. Econ. Entomol., 77: 514-518.

Hall, R. A. (1981): The fungus, *Verticillum lecanii* as a microbial insecticides against aphids and scales in Burges, H. D. (Ed.) Microbial control of pests and plant diseases 1970-1980 Pp 483-498. Academic Press, New Yourk, N. Y.

Hall, R. A. (1982): Control of whitefly, *Trialeurodes vaporariorum,* and cotton aphid, *Aphis gossypii* in glasshouses by two isolates of the fungus, *Verticillum lecanii*. Annals of Applies Biology, 101 (1): 1-11.

Hassani, M. O. Zimmermann and S. C. Vidal (1998): Effect of different strains of entomopathogenic fungi against two cotton pests: *Spodoptera littoralis* and *Helicoverpa armigera* (Lepidoptera : Noctuidae). In : British Mycological Socity (ed.) the future of fungi in the control of pests, weeds and diseases. International Symposium of the British Mycological Society, 5-9 April, 1998 Southampton Univ., UK, 117.

Harper, A. M. and H. C. Huang (1980): Evaluation of the entomophagous fungus, *Verticillum lecanii* (Moniliaceae) as a control agent for insects. Environ. Entomol., 15: 281-284.

Lacey, L. A.; Frutos, R. Kaya; H. K. and Vall, P. (2001): Insect pathogens as biological control agents : Dothey have a future. Biological Control, 21 (3): 230-248.

Parker, B. L. (1998): Fungal pathogens, biocontrol of thrips in greenhouses. Future research directions for IPM Grower Talks. June 105.

Samson, and Rombach (1985): Biology of the fungus, *Verticillum*and *Ascherosonia.* Pp. 34-42 in N.W.Hussey & Scopes(eds.), Biological pest control, the Glasshouse Experience. Cornell Univ. Press, Ithaca N.Y.

تأثير فعالية فطر *Verticillum lecanii* علي دودة اللوز الشوكية و دودة اللوز القرنفلية

عادل محمد حنفي عزب ، أميرة محمد رشاد و صفاء حسين
معهد بحوث وقاية النباتات- مركز البحوث الزراعية- الدقي- الجيزة- مصر

تم دراسة فاعلية فطر *Verticillum lecanii* علي الأطوار المختلفة لنوعين من ديدان اللوز (دودة اللوز الشوكية ودودة اللوز القرنفلية).

أوضحت النتائج أن فطر الفرتسيليم فعال ضد بيض ويرقات كلا النوعين حيث أدي الي خفض في معدل فقس البيض المعامل بالفطر. كما إتضح أن البيض واليرقات حساسة للإصابة بالفطر والغالبية العظمي من اليرقات الناتجة من بيض معامل بالفطر فشلت في التطور الي أفراد كاملة وماتت في النهاية وذلك في حالة دودة اللوز الشوكية ودودة اللوز القرنفلية.

وبحساب قيم LC_{50} ضد بيض وكذلك يرقات دودة اللوز الشوكية وجدت ١,١X ١٠^{٧} جرثومة/ملي، ١,٨X ١٠^{٧} جرثومة/ملي، علي الترتيب بينما بلغت قيم LC_{50} ضد بيض وكذلك يرقات دودة اللوز القرنفلية وصلت الي ١X ١٠^{٧} جرثومة/ملي، ١,٥X ١٠^{٧} جرثومة/ملي، علي الترتيب

كما أوضحت النتائج أن جميع أطوار دودة اللوز القرنفلية أكثر حساسية لفطر الفرتسيليم من دودة اللوز الشوكية.