International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(5): 1467-1469

Received: 10-07-2017
Accepted: 11-08-2017

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In vitro compatibility of *Verticillium lecanii w*ith insecticides

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Abstract
The present study was to evaluate some selected insecticides for their compatibility with *V. lecanii*. Among the four tested insecicides *i.e* novaluron, chlorfenapyr, acetamiprid and fenvalarate, novaluron showed highest radial growth (62.26) mm, highest condial concentration (1.70 x 10^9) and highest conidial viability (95.08%) followed by chlorfenapyr, acetameprid and fenvelerate respectively. So that novaluron was the most compatible insecticide with *Verticillium lecanii*. *V. lecanii.* has been recognized as an entomopathogen with high potential in biological control aphids and mealy bugs.

Keywords: Insecticides. *V. lecanii*, compatibility, radial growth, conidial concentration and conidial viability

Introduction
Integrated pest management is gaining importance in recent years in view of risk of synthetic chemical towards environmental pollution, health hazards. Due to its indiscriminate and excessive use which also affect the natural enemies of insect pest adversely and disturb the ecosystem. In such condition bio agent play an important and effective role. *V. lecanii* is one of the promising fungal bio agent occurring in all climatic condition. *V.lecanii*. has been recognized as an entomopathogen with high potential in biological control aphids and mealy bugs. The influence of chemical pesticides on germination and growth of *V. lecanii* has been studied extensively by Rebollar *et al.* (1997) [5], Olan *et al.* (2003) [2]. Each crop suffers from many pests and diseases, which are to be controlled by chemical as well as biological methods. For this reason, it is necessary to assess the effect of pesticides on biological agents. After screening it is observed that very little information is available on compatibility of *V. lecanii* with pesticides. The present study was therefore, undertaken to evaluate some pesticides for their compatibility with *V. lecanii.*

Material and Methods
In vitro compatibility of *V. lecanii* with different insecticides
The study was taken up to assess the impact of different insecticides on radial growth, conidial concentration and conidial viability of *V. lecanii*. Following insecticides were taken as treatments to ascertain the compatibility of *V. lecanii* with commonly used insecticides.

Insecticide	Concentration
Fenvalarate	0.1 ml/100 ml
Novaluron	0.1 ml/100 ml
Chlorfenapyr	0.15 ml/100 ml
Acetamiprid	0.02 gms/100 ml

The required components of SDAY medium will be weighed and dissolved in 100 ml of distilled water. Four flasks of with 100 ml media respectively were prepared for four different test insecticides. After cotton plugging, wrapped with the paper media were kept for autoclaving at 121 degrees with 15 lbs pressure for 15 to 20 minutes. After sterilization, the media was allowed to cool to tolerable temperature for handling. After cooling of medium the insecticides were added in given concentrations. The media then was poured into Petri plates and will be allowed for solidification. After solidification the plates were inoculated with the pure culture of *V. lecanii*. Control plate (without insecticide) was also maintained for comparison purposes.

The plates will be kept for incubation at 25±5 ^{0}C temperatures for 3 to 5 days.
The compatibility was calculated by using following formula.

$$\% \text{ of Inhibition} = \frac{\text{Control} - \text{Treatment}}{\text{Control}} \times 100$$

Results and discussion

Compatibility of selected Insecticides on biological properties of *V. lecanii*

The effect of four Insecticides *viz*., fenvalarate, novaluron, chlorfenapyr and acetamiprid was tested on the radial growth, conidial concentration and conidial viability of *V. lecanii*.

Radial growth

The overall radial growth in different treatments revealed that the novaluron, treated SDAY media recorded highest radial growth of *V. lecanii* with 62.26 mm followed by chlorfenapyr (60.80 mm), acetamiprid (58.93 mm) and fenvalarate (54.66 mm) respectively, as against 67.46 mm in control. All the treatments including control were significantly different from each other, which indicated that all the treatments were not safe to *V. lecanii*, but among them the insecticides, novaluron was safer when compared to other insecticides followed by chlorfenapyr.
The Percent inhibition of radial growth over control was the lowest in novaluron (7.87%), chlorfenapyr (9.86%), acetamiprid (12.63%) and fenvalarate (18.98%) respectively and all the above insecticides were significantly different from each other.

Conidial concentration

The results pertaining to the conidial concentration per ml in different insecticide treated SDAY media of *V. lecanii* are presented in table below. The novaluron recorded highest conidial concentration of 1.70 x 10^9 and the insecticide was on par with the control (1.77 x 10^9/ml) followed by chlorfenapyr (1.60 x 10^9/ml) and significantly different from novaluron and control but on par with acetamiprid (1.52 x 10^9/ml) respectively. The least conidial concentration was observed in fenvalarate (1.36 x 10^9/ml) which was significantly different from control and all other treatments. The Percent reduction conidial concentration over control was highest in fenvalarate (24.89%) followed by acetamiprid (14.17%) and chlorfenapyr (9.61%), respectively. The lowest Percent reduction conidial concentration over control was observed in novaluron with 3.95% and all the treatments were significantly different from each other.

Conidial viability

Novaluron and chlorfenapyr recorded 95.08 and 92.86 Percent viable conidia, respectively followed by acetamiprid and fenvalarate with 90.50 and 88.64 Percent respectively. The treatments were significantly different from each other and also from control, which recorded 98.68 Percent conidial viability. The Percent inhibition of conidial viability over control in the descending order of 10.18, 8.30, 5.90 and 3.65 Percent was recorded in fenvalarate, acetamiprid, chlorfenapyr and novaluron respectively and all the treatments significantly differed among themselves. novaluron showing least percent reduction over all the treatments .
All the test strains of *B. bassiana* were found highly compatible with the insecticides imidacloprid and spinosad by recording no inhibition of growth, sporulation and viability as reported by Rajanikanth (2007) [3]. Raja Goud (2009) [4] found that the overall radial growth, conidia per unit area, conidial viability and time taken for 50% germination of *B. bassiana* in different insecticidal treatments *viz.,* indoxacarb, spinisad, novaluran and cartap hydrochloride revealed that all the treatments including control were on par with each other and safe to *B. bassiana*. Among the insecticides, the spinosad was found to be safer insecticide when compared with other insecticides even though all were statistically on par with each other. Amutha and Gulsar Banu, (2012) [1] reported that among biopesticides, *Pochonia lecanii*, only one insecticides rated as hazardless (chlorpyriphos), four insecticides as slightly toxic (econeem, acetamprid, endosulfan & thiodicarb), two insecticides as moderately toxic (spinosad & quinalphos) and five as highly toxic (profenophos, triazophos, imidacloprid, indoxacarb & methyldemeton).

Table 1: Percent of inhibition of *V. lecanii* with different Insecticides

Treatments	Insecticides	Mean radial growth (mm)	Percent inhibition of radial growth over control	Mean conidial concentration (×10^9)/ml	Percent inhibition of Conidial concentration over control	Mean Percent of conidial viability	Percent inhibition of Conidial viability over control
T1	Fenvelerate (0.1ml/100ml)	54.66 e (47.65)	18.98 e (25.81)	1.36 c (6.69)	24.89 e (29.90)	88.64 e (70.27)	10.18 e (18.59)
T2	Novaluron (0.1ml/100ml)	62.26 b (52.07)	7.87 b (16.23)	1.70 a (7.48)	3.95 b (11.29)	95.08 b (77.17)	3.65 b (10.97)
T3	Chlorfenapyr (0.15ml/100ml)	60.80 c (51.21)	9.86 c (18.22)	1.60 b (7.26)	9.61 c (18.00)	92.86 c (74.53)	5.90 c (13.98)
T4	Acetamiprid (0.02gm/100ml)	58.93 d (50.12)	12.63 d (20.76)	1.52 b (7.07)	14.17 d (22.05)	90.50 d (72.02)	8.30 d (16.72)
Control (*V.lecanii*)		67.46 a (55.20)	0.00 a (0.00)	1.77 a (7.64)	0.00 a (0.00)	98.68 a (83.38)	0.00 a (0.00)
SE(m)±		0.189	0.603	0.073	0.697	0.392	0.422
CD (0.05%)		0.561	1.791	0.217	2.071	1.163	1.254

Values are given in parentheses are angular transformed value
Figures indicated by same letter are not significantly different from one another as per DMRT

Conclusion

Novaluron was found compatible with *V. lecanii* in laboratory condition. Growth of inhibition of pathogenic fungi is useful criterion for initial testing of its compatibility.

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