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Compatibility of entomopathogenic fungi *Verticillium lecanii* with other bio pesticides in laboratory conditions

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Abstract
Most of insect pest are becoming resistant to chemical pesticides 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. *Verticillium lecanii* showed excellent compatibility with existing biological control measure and could be used in combination with several widely used pesticides including fungicides. Therefore, the present study was undertaken to evaluate some bio pesticides for their compatibility with *V. lecanii*.

Keywords: Compatibility, *V. lecanii*, entomopathogenic fungi, bio pesticides

Introduction
Most of insect pest are becoming resistant to chemical pesticides due to its indiscriminate and excessive use which also affect the natural enemies of insect pest adversely and disturb the ecosystem. In such condition bioagent play an important and effective role. *V. lecanii* is one of the promising fungal bioagent occurring in all climatic condition. *Verticillium lecanii* showed excellent compatibility with existing biological control measure and could be used in combination with several widely used pesticides including fungicides (Wilding, 1972) [4]. The potential of these fungi in controlling white flies and aphids have been intensively studied in laboratory bioassay and in field trials (Rana and Singh, 2002) [2]. The influence of chemical pesticides on germination and growth of *V. lecanii* has been studied extensively by Rebollar *et al.* (1997) [3], Olan *et al.* (2003) [1]. 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 Bio Pesticides
Bio Pesticides are eco-friendly in nature. However, there is a need to assess compatibility between different Bio Pesticides that are being commonly used during recent times due to chances of synergism or antagonism or mutualism between organisms or their metabolites. Compatibility studies between the bio pesticides were done for *V. lecanii* with following Bio Pesticides as treatments.

1. *Beauveria bassiana* (5g/lit)
2. *Metarhizium anisopliae* (5g/lit)
3. *Pseudomonas florescens* (5g/lit)
4. *Trichoderma viride* (5g/lit)

The required components of SDAY medium were weighed and dissolved in 100 ml of distilled water. Media was in flasks and after cotton plugging, wrapped with the paper media they was 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. The media then was poured into petri plates and was allowed for solidification. After solidification the plates were inoculated with the pure culture of *V. lecanii*. After the solidification the plates were inoculated with *V. lecanii* at one side of the plates and test Bio Pesticides were kept opposite side in individual plates with a sterile cork borer. In case of bacteria streak opposite

side with a sterile inoculation loop. Control plate 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 Bio pesticides on biological properties of *V. lecanii*

The effect of four Bio pesticides *viz*., *Beauveria bassiana, Metarhizium anisopliae Pseudomonas florescens and Trichoderma viride* was tested on the radial growth, conidial concentration and conidial viability of *V. lecanii*.

Radial growth

The findings on radial growth of *V. lecanii* on SDAY media with dual culture technique in different treatments revealed that the *Beauveria bassiana,* culture plate recorded highest radial growth of 47.55mm followed by *Metarhizium anisopliae,* 44.10 mm*, Pseudomonas florescens,* 43.00 mm and *Trichoderma viride* 35.20 mm respectively, as against 67.59 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 biopesticides, the *Beauveria bassiana* was safer when compared to other biopesticides. *Trichoderma viride* was the most harmful to *V. lecanii* and not compatible with each other. *Trichoderma viride* showed antagonist effect on *V. lecanii*.

The per cent inhibition of radial growth over control was the lowest in *B. bassiana* (29.64%) followed by *M. anisopliae* (34.75%), *P. florescens* (36.28%) and *T. viride* (47.91%), respectively and all the above biopesticides were significantly different from each other.

Conidial concentration

The results pertaining to the conidial concentration of *V. lecanii* per ml on SDAY media in different biopesticides treatments are presented in Table 4.4 and Figure 4.4. The *B. bassiana,* and *M. anisopliae* culture plate recorded highest conidial concentration of 1.60 x 10^9 and 1.56 x 10^9/ml respectively and above biopesticides were on par with each other but significantly different and inferior to conidial concentration of control (1.77 x 10^9). The per cent reduction of conidial concentration of *B. bassiana,* and *M. anisopliae* was 9.64% and 11.86% over control respectively. *M. anisopliae,* and *P. florescens,* culture plate produced conidial concentration of 1.56 x 10^9 and 1.48 x 10^9/ml respectively, which were on par with each other but significantly different from control. The per cent reduction of conidial concentration of *M. anisopliae* and *P. florescens* was 11.86% and 16.42% over control respectively.

Conidial viability

B. bassiana, and M. anisopliae produced 95.42 and 94.24 per cent viable conidia, respectively followed by *P. florescens,* 92.7. The treatments were significantly different from each other and also from control, which recorded 98.64 per cent conidial viability. The per cent inhibition of conidial viability over control in the descending order of 5.56, 4.46 and 3.18 per cent was recorded in *Pseudomonas florescens, Metarhizium anisopliae* and *Beauveria bassiana,* respectively and all the treatments significantly differed among themselves.

Gokil Prasad (2013) [5] reported similar findings that compatibility of *T. harzianum* with *B. bassiana, M. anisopliae, P. lecanii* reavealed that *T. harzianum* did not exihibit compatibility and significantly reduced average radial growth of all three fungi.

Table 1: Effect of selected Bio pesticides on the conidial concentration and conidial viability of V. lecanii

Treatments (Bio pesticides)	Overall growth	Per cent of inhibition of radial growth over control	Mean Conidial concentration (×10^9)/ml	Per cent inhibition of Conidial concentration (×10^9) over control	Mean conidial viability (%)	Per cent inhibition of Conidial viability over control
Beaveria bassiana (5g/lit)	47.55 b (43.57)	29.64 b (32.96)	1.6 b (7.26)	9.64 b (18.02)	95.42 b (77.62)	3.18 b (10.24)
Metarhizium anisopliae (5g/lit)	44.10 c (41.59)	34.75 c (36.10)	1.56 bc (7.17)	11.86 b (20.06)	94.24 c (76.10)	4.46 c (12.16)
Pseudomonas florescens (5g/lit)	43.00 d (40.95)	36.28 c (37.02)	1.48 c (6.98)	16.42 c (23.87)	92.79 d (74.41)	5.56 d (13.59)
Trichoderma viride (5g/lit)	35.20 e (36.37)	47.91 d (43.78)	-----	------	------	---
Verticilium lecanii	67.59 a (55.28)	0.00 a (0.00)	1.77 a (7.64)	0.00 a (0.00)	98.64 a (83.27)	0.00 a (0.00)
SE(m)±	0.204	0.342	0.072	0.680	0.335	0.372
CD (0.05%)	0.605	1.016	0.216	2.056	0.014	1.126

Values are given in parentheses are angular transformed value.

Plate 1: Compatibility of *Verticillium lecanii* with different Biopesticides

Conclusion

B. bassiana was found compatible with *V. lecanii* in laboratory condition. The laboratory results on artificial media may not be reproducible in field as there will be degradation of toxicants. Thus, when the product is determined in the laboratory, no doubt that its selectivity under filed condition will stand. On the other hand, the high toxicity under *in vitro* of a given formulation may suggest similar toxicity under field conditions. However for field studies the inhibition of conidial germination should be the key factor to be considered. It needs field confirmation.

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