Compatability of *Metarhizium anisopliae* and *Pochonia lecanii* with insecticides

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ABSTRACT

Among biopesticides, *Metarhizium anisopliae,* was hazardless with chlorpyriphos and econeem, five were slightly toxic (spinosad, acetamprid, quinalphos, endosulfan & thiodicarb), two as moderately toxic (imidacloprid & triazophos), three were highly toxic (profenophos, indoxacarb &methyldemeton). In case of *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). Results of the present study suggested that except few insecticides, the rest of the insecticides tested can be safely used along with the entomopathogenic fungi.

Key words: Compatability, *Metarhizium anisopliae, Pochonia lecanii.*

Biological control, in particular when accomplished by entomopathogens, is a technique that should be considered as an important pest population density reduction factor in IPM programmes. *Metarhizium anisopliae* and *Pochonia lecanii* were registered biopesticides with a broad host range for management of several crop insect pests.

Data from such studies would enable farmers to select appropriate compounds and schedule microbial and chemical pesticide treatments so that benefits from compatible sets can be accrued and, with noncompatible pairs, the deleterious effect of the chemical on the microbe in the biopesticide can be minimized (Mahto & Yadav, 2010). In IPM programmes it is essential to know the influence of compatibility between entomopathogenic fungi and pesticides used in crop protection. Therefore, keeping this in view, present study was taken-up *in-vitro* condition.

Materials and Methods

The insecticide doses were calculated for field application rate based on 500 litres/ha. Twelve insecticides were evaluated by poisoned food technique. 20 ml of PDA medium was sterilized in individual boiling tubes and the insecticide emulsions of required concentration were incorporated into the melted sterile PDA aseptically, thoroughly mixed, poured into 9 cm dia sterile Petri dishes and allowed to solidify under laminar flow cabinet. An agar disc along with mycelium mat of *M. anisopliae* and *P. lecanii* were cored from the periphery of 10 day old colony of respective fungus by 10 mm dia cork borer and transferred in the centre of PDA plate. Growth medium without insecticide but inoculated with mycelial disc served as untreated check. The plates were sealed with parafilm and incubated at room temperature for 14 days to allow maximum growth, replicated three times. The diameter of growing culture in excess of the plugs in each Petri dish was measured on 14 days. (when radial growth in the control plate fully covered the medium) and also on 30 days after inoculation. The data were expressed as % growth inhibition of *M. anisopliae* and *P. lecanii* by insecticide treated PDA using standard known technique.

Results and Discussion

All the treatments showed significant difference compared to control. Two insecticides were hazardless (chlorpyriphos & econeem), five insecticides as slightly toxic (spinosad, acetamprid, quinalphos, endosulfan & thiodicarb), two insecticides as moderately toxic (imidacloprid & triazophos), and three as highly toxic (profenofos, indoxacarb & methyldemeton). On 30 days after inoculation, two insecticides were hazardless (chlorpyriphos & econeem), eight as slightly toxic (spinosad, profenophos, imidacloprid, triazophos, quinalphos, acetamprid, endosulfan & thiodicarb), two as moderately toxic (indoxacarb & methyldemeton) (Table 1). In case of *P. lecanii,* only one insecticide 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 (profenofos, triazophos, imidacloprid, indoxacarb & methyl/demeton). On 30 days after inoculation, only one insecticides classified as hazardless (chlorpyriphos), six insecticides were slightly toxic (spinosad, quinalphos, econeem, acetampride, endosulfan & thiodicarb), four as moderately toxic (profenophos, imidacloprid, triazophos & indoxacarb) one as highly toxic (methyl/demeton) (Table 2). Haseeb (2009) tested 13 insecticides against *Beauveria bassiana*, 12 were found to reduce mycelial diameter up to 94.6% whereas dimethoate was least toxic to fungus.

In the present study chlorpyriphos showed no toxic effect. In earlier reports, insecticides like chlorpyriphos, endosulfan influenced the conidial viability and growth of entomogenus fungus (Isaiah *et al*., 2005a). Adverse effect of endosulfan, on growth and sporulation of *M. anisopliae* was reported by Isaiah *et al.* (2005b). They observed

Table 1. Compatibility of *Metarhizium anisopliae* with insecticides.

Treatments	14 days after inoculation			30 days after inoculation		
	Mean Dia. of mycelial growth (mm)*	% reduction over control	Grade	Mean Dia. of mycelial growth (mm)*	% reduction over control	Grade
Chlorpyriphos 20 EC	48.67±2.02^{b}	41.3	1	53.67±3.01^{b}	37.7	1
Spinosad 45 % SC	28.83±3.55^{f}	65.2	2	33.67±4.01^{ef}	60.9	2
Profenofos 50 EC	8.17±1.26^{h}	90.1	4	19.17±4.01^{hi}	77.8	2
Imidacloprid 17.80% SL	16.17±1.26^{g}	80.5	3	24.67±3.40^{gh}	71.4	2
Triazophos 40 EC	15.33±2.52^{g}	81.5	3	27.83±2.75^{fg}	67.7	2
Econeem 1%	41.83±1.53^{c}	49.5	1	45.50±4.50^{c}	47.2	1
Quinalphos 25 EC	32.00±2.65^{ef}	61.4	2	37.00±1.50^{de}	57.1	2
Acetamprid 20%	36.00±3.50^{de}	56.5	2	41.50±3.04^{cd}	51.8	2
Indoxacarb 14.5 % EC	8.00±2.18^{h}	90.3	4	15.50±2.78^{i}	82.0	3
Endosulfan 35 EC	32.67±4.54^{ef}	60.6	2	38.17±5.58^{de}	55.7	2
Thiodicarb 75 WP	39.00±4.77^{cd}	52.9	2	40.83±3.40^{cd}	52.6	2
Methyl/demeton 25 EC	8.00±2.18^{h}	90.3	4	16.83±4.01^{i}	80.5	3
Untreated check	82.83±5.25^{a}	-		86.17±3.33^{a}		

* Mean of three replications; In a column, mean followed by common letters are not significantly different (P = 0.05) by DMRT

Table 2. Compatibility of *Pochonia lecanii* with insecticides

Treatments	14 days after inoculation			30 days after inoculation		
	Mean Dia. of mycelial growth (mm)*	% reduction over control	Grade	Mean Dia. of mycelial growth (mm)*	% reduction over control	Grade
Spinosad 45 % SC	16.00±2.29[e]	80.7	3	17.67±2.08[e]	78.7	2
Profenofos 50 EC	7.83±2.02[f]	90.5	4	9.33±2.02[f]	88.7	3
Imidacloprid 17.80% SL	7.50±0.50[f]	91.0	4	9.00±0.50[f]	89.1	3
Triazophos 40 EC	7.83±1.76[f]	90.5	4	9.17±1.26[f]	88.9	3
Econeem 1%	36.50±4.92[c]	55.9	2	38.17±4.25[c]	53.9	2
Quinalphos 25 EC	16.17±1.04[e]	80.5	3	17.50±0.87[e]	78.89	2
Acetamprid 20%	34.67±3.69[cd]	58.2	2	35.83±3.33[cd]	56.7	2
Indoxacarb 14.5 % EC	7.50±1.32[f]	91.0	4	9.83±1.04[f]	88.1	3
Endosulfan 35 EC	30.83±3.82[d]	62.8	2	32.67±3.55[d]	60.6	2
Thiodicarb 75 WP	33.67±3.25[cd]	59.4	2	35.17±2.75[cd]	57.6	2
Methyl/demeton 25 EC	7.33±1.76[f]	91.2	4	7.83±1.26[f]	90.5	4
Untreated check	82.83±5.25[a]			82.83±5.25[a]		

* Mean of three replications; In a column, mean followed by common letters are not significantly different (P = 0.05) by DMRT

extremely detrimental effects of chlorpyriphos to various developmental stages of *M. anisopliae* while methomyl was moderately toxic. In this study, spinosad and profenophos was observed as slightly toxic. This is similar to findings of Purwar and Sachan (2005), spinosad was found comparatively safe to the fungi, indoxacarb and profenophos were investigated to be less detrimental to the fungi (Kumar & Rao 2007a). Profenophos were compatible with significantly lesser inhibition in growth and conidial germination of the fungi. Also there are numerous examples where the application of chemical pesticides enhanced the efficacy of entomopathogens against insect pests (Purwar & Sachan, 2005). With regard to the neem based insecticides tested in the present study, azadirachtin 3 % (econeem) was found to be hazardless (Isaiah *et al*., 2005b). Azadirachtin (0.3% EC) were very well tolerated by *M. anisopliae* at 1000 and 2000 ppm concentrations (Isaiah *et al*., 2005a). However, with this compatability test, contradictory results were reported. The observed difference could be due to inherent variability of chemicals to biological creatures. Although the different insecticides tested inhibited the growth of entamopathogens in the poisoned medium *in vitro*, the combined use of the fungus and insecticides cannot completely be ruled out. Kumar and Rao (2007b) also reported similar results on growth and sporulation of *Ascochyta*. Certain insecticides were combined at sub-lethal doses with entomopathogenic fungi for obtaining better control of the pest species. Considering this, it is worth exploring the effects of these insecticides at sub-lethal doses on the fungus as two-in-one mix strategy. While doing so, precaution should also be taken because these compounds at sub-lethal doses may end up with complications like resurgence of sucking insects. Singh and Singh (2007) reported monocrotophos was found to be least effective against fungal bioagents. Seal *et al.* (2010) reported better control of cut worms with EPN used with nematicides.

In vitro studies have the advantage of exposing the microorganism to the products/formulations to the maximum extent possible, which does not occur under field conditions, where several factors act as barriers against such exposure, protecting the entomopathogen. For example, imperfect plant coverage by the product provides a spatial refuge for the entomopathogen. Therefore, once an agrochemical has been verified to be innocuous in the laboratory, it will undoubtedly be selective under field conditions. On the other hand, the high toxicity of a product *in vitro* not always means that the same will occur in the field, but is evidence that it may be possible to occur. Thus, when an IPM strategy is devised, it is important to take into account the compatibility of products sprayed on the crop, avoiding the use of most toxic, or using them during seasons when the effect over a natural control agent is minimized. Therefore, the toxic effect impact on the control agent will be smaller, contributing indirectly to control the host pest-insect and, consequently, to reduce damage in the cultivated field. As natural control is implemented, less chemical insecticides will have to be used, resulting in benefits for the farmer and the environment.

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