Compatibility of Entomopathogenic Fungi *Paecilomyceslilacinus* with Insecticides Used in Banana Cultivation

Ann Mary Mathew, Vimi Louis

Kerala Agricultural University, Banana Research Station, Kannara, Thrissur-680 652, India
E-mail: brskannara[at]kau.in, Ph No. 0487-2699087

Abstract: ***Background**: Integrated pest management is an approach of pest control which utilizes cultural, physical, biological and chemical methods. Biocontrol is an integral component of integrated pest management of banana. Use of biocontrol agents like entomopathogenic fungi along with compatible insecticides enhance the pest control efficiency and thereby reduce the quantity of insecticides required. **Method**: The in vitro fungitoxic effect of insecticides used in banana cultivation viz; acephate (SP75), chlorpyrifos (EC20), quinalphos (EC25), imidacloprid (SL17.8%), fipronil (SC5%), cartap hydrochloride (G4%), flubendiamide (SC39.35m/m), dimethoate (EC30%) and chlorantraniliprole (0.4%G) on the vegetative growth of the fungus Paecilomyceslilacinus was evaluated by poisoned food technique. Based on the fungi toxicity values, the insecticides were classified into non-compatible / least compatible/ moderately compatible and compatible types. **Results**: Based on the compatibility to Paecilomyceslilacinus, the insecticides quinalphos and chlorpyrifos were classified as non-compatible; fipronil, dimethoate and cartap hydrochloride as least compatible; acephate, chlorantraniliprole and flubendiamide as moderately compatible and imidaclopridas compatible. **Conclusions**: The insecticide imidacloprid can be used in banana IPM programs as it is compatible with the entomopathogenic fungus Paecilomyceslilacinus, an important biocontrol agent for nematodes and other insect pests of banana.*

Keywords: Integrated pest management, Entomopathogenic fungi, Compatibility, *Paecilomyceslilacinus*

1. Introduction

Biological control, particularly using entomopathogenic fungi, is an integral part of Integrated Pest Management (IPM) strategies used for reducing the population density of many pests (De Oliveira et al., 2003). *Paecilomyces* is a genus of nematophagous fungus which kills harmful nematodes by pathogenesis, causing disease in the nematodes. Thus the fungus can be used as a bionematicide to control nematodes by applying to soil. *Paecilomyceslilacinus* has been considered to have the greatest potential for the application as a biocontrol agent in subtropical and tropical agricultural soils (Sardul Singh et al., 2013).

Nevertheless, insecticides are always in demand to suppress fast growing insect populations in the field. Therefore, fungi cannot replace need for chemical insecticides in all commercial agricultural crops. (Neves *et al.*, 2011). Number of studies have made where use of selective insectidal chemicals have increased the efficiency of entomopathogenic fungi against pests (Quintela and Mc Coy, 1998; Dayakar *et al.*, 2000; Sarebrov *et al.*, 2005; Purwar and Sachan, 2006).For the use of *P.lilacinus*in banana IPM, it is essential to determine the toxic effects of commonly used pesticides to the fungus. Keeping this in view, an investigation was taken-up to study the fungi toxicity of insecticides with *P.lilacinus* under in-*vitro* condition.

2. Materials and Methods

The present study was conducted at Kerala Agricultural University, Banana Research Station, Kannara, Thrissur, Kerala, India. The experiment was laid out in completely randomized design. The insecticides selected for the study are given in. was those commonly used in pest management of banana cultivation *viz*; quinalphos, chlorpyrifos, chlorantraniliprole, acephate, dimethoate, imidacloprid, flubendiamide, fipronil andcartaphydrochloride (Table1).

Table1: Insecticides used in for compatibility study

Sl.No.	Insecticide - Chemical Name	Trade Name	Selected Dose
1	Chlorpyriphos	Radar 20EC	2.5 ml/l
2	Quinalphos	Ekalux 25 EC	2.5 ml/l
3	Chlorantraniliprole	Coragen 0.4% G	0.3 ml/l
4	Acephate	Asataf 75SP	1.50g/l
5	Dimethoate	Tafgor 30 EC	1.50 ml/l
6	Imidacloprid	Tatamida 17.80SL	0.5 ml/l
7	Flubendiamide	Fame39.35SC	0.1 ml/l
8	Fipronil	Agadi 5SC	3.0 ml/l
9	Cartap hydrochloride	Cartap	10g/l

The effect of recommended dose of these insecticides on the vegetative growth of *P.lilacinnus* was evaluated by poisoned food technique in Potato dextrose broth (PDB) medium. The PDB was sterilized in glucose bottles at the rate of 300 ml per bottle and the insecticide emulsions of required concentration were incorporated into it aseptically, under laminar flow cabinet. The fungal disc of 10mm diameter was removed from the periphery of 10 day old culture of *P.lilacinnus* by cork borer and transferred in to the PDB of the bottle. The PDB without insecticide was served as control. The bottles were sealed with cotton plug and incubated at room temperature for 15 days to allow maximum growth. Each treatment was replicated thrice. At the end of incubation, the mycelial mat was took out from culture bottles and drained over filter paper and wet weight of mycelia mat was recorded. Then it was dried at 40±3˚C and the dry weight was recorded at an interval of 24 hours till consistent value was obtained. Percent inhibition was found out using the equation,

PI= C-T/C X100

Where, PI – Percent Inhibition; C –Weight of mycelialmat in control; T –Weight of mycelialmat in treatment

The insecticide with PI up to 25% was classified as compatible; 25-50% as moderately compatible; 50-75% as least compatible and above 75% as non-compatible. The data obtained from the experiment were statistically analyzed using WASP (Web Based Agricultural Statistics Software Package) a product of Central Coastal Agricultural Research Institute under Indian Council of Agricultural Research (ICAR), New Delhi.

3. Results and Discussions

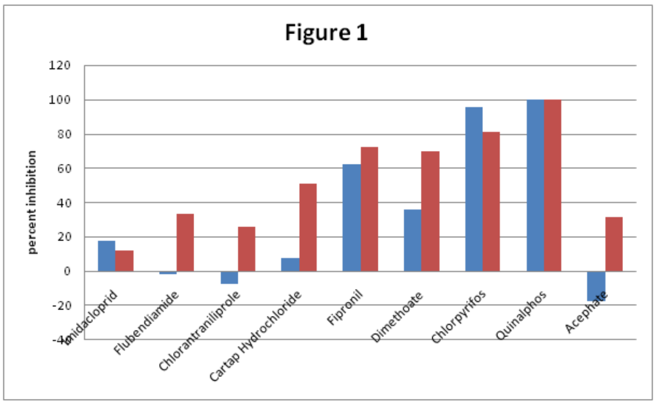
Variation in the growth of *P.lilacinus* was observed with insecticides. After 15 days of incubation a pinkish purple coloured mycelial mat was formed on the media in the bottles. The wet weight and dry weight of mycelial mat was recorded, and given in Table 2.The percentage inhibition of various insecticides to the mycelial growth of *P.lilacinus* was recorded and presented in Figure 1.

There was significant difference in the wet weight and dry weight of the fungus with insecticides. Among the insecticides, the maximum wet weight (21.57 g) was recorded in acephate. This was followed by chlorantraniliprole (19.65 g), flubediamide (18.62g) cartap hydrochloride (16.90 g) and imidacloprid (15.11g). Cent per cent inhibition of fungal growth was observed in quinalphos. The maximum dry weight among the insecticides, was recorded in imidcloprid (2.77 g) which was followed by chlorantraniliprole (2.34 g). Acephate and flubendiamide were next best treatments with 2.13 g and 2.11 g respectively.

Table 2: Effect of Insecticides on Fungal Growth of *Paecilomyceslilacinus*

Treatment.	Insecticide - Chemical Name	Wet weight (g)	Dry weight (g)
T_1	Chlorpyriphos	0.84 g	0.59 g
T_2	Quinalphos	0.0 g	0.0 h
T_3	Chlorantraniliprole	19.65 b	2.34 c
T_4	Acephate	21.57 a	2.13 d
T_5	Dimethoate	11.73 e	0.96 f
T_6	Imidacloprid	15.11 d	2.77 b
T_7	Flubendiamide	18.62 bc	2.11 d
T_8	Fipronil	6.89 f	0.88 f
T_9	Cartap hydrochloride	16.90 cd	1.55 e
T_{10}	Control	18.34 bc	3.16 a
	CD (0.05)	1.91	0.21
	CV	8.65	7.53

Based on the per cent inhibition in dry weight, the insecticides were classified into different compatibility groups. Accordingly imidacloprid was classified as compatible, flubendiamide, acephte and chlorantriniliprole as moderately compatible, cartap hydrochloride, dimethoate and fipronil as least compatible, chlorpyrifos and quinalphos as non compatible.



Neves *et al.*, (2001) stated that the insecticides imidacloprid, thiamethoxam and cyromanine did not show any inhibitory effect on the vegetative growth of *P. lilacinus* and other entomopathogenic fungus like *Beauveriabassiana, Metarhiziumanisopliae.* According to James and Elzen (2001) and Alizadeh *et al.*, (2007), imidacloprid had no negative effect on *P.lilacinus* and *B. bassiana.* In the present study also, the least inhibitory effect on the vegetative growth of *P. lilacinus* was recorded by imidacloprid.

Masarat (2009) reported that chlorpyriphos and endosulfan strongly inhibit the growth of *B. bassiana*. Oliviera *et al.* (2003) reported triazophos and chlorpyriphos showed cent per cent inhibition of conidial germination of *B.bassiana*. Ghini and Kimati, (2000) reported that organophosphate compounds interfere directly on membrane permeability of the cells and synthesis of enzymes, consequently affecting the metabolic process of the organism. Accordingly the organophosphorous insecticides used in present study also showed high inhibition of vegetative growth of *P. lilacinus*.

In summary, the combined use of *P.lilacinus* together with compatible chemical pesticides is one of the most promising strategies for integrated pest management programs. The insecticide imidacloprid can be recommended in banana IPM programs, since it was compatible with the entomopathogenic fungus *P.lilacinus*, one of the commonly used biocontrol agent in banana. Compared to other insecticides, imdclopid will protect *P.lilacinus* in the environment, contributing to biological control of nematodes and other insect pests in banana. Organophosphate compounds, neither chlorpyrifos nor quinalphos are compatible to use in IPM along with *P.lilacinus*.

References

[1] Alizadeh, A., Samih, M. A., Khezri, M. and Riseh, R. S. 2007.Compatibility of *Beauveriabassiana* (Bals.) Vuill. with several pesticides. *Int. J. Agric. Biol.* 9 (1): 31-34

[2] Dayakar, S., K.R. Kanaujia, R.R.S. Rathore. 2000. Compatibility of entomogenous fungi with commonly used insecticides for the management of

Spodopteralitura (Fab.) S. Ignacimuthu, A. Sen (Eds.), *Microbials in Insect Pest Management*, Oxford and IBH Publishing Co. Pvt. Ltd, N. Delhi,, pp. 47–52

[3] Ghini R., Kimati H. 2000. Resistĕncia de fungos a fungicidas.Jaguariuna, EmbrapaMeio Ambient, 78 pp

[4] James, R.R. and G.W. Elzen, 2001.Antagonism between *Beauveriabassiana* and imidacloprid when combined for *Bemisiaargentifolii* (Homoptera: Aleyrodidae) control. *J. Econ. Ento*. 94: 357–61

[5] Masarat, H. 2009. Compatability of *Beauveriabassiana* (Balls.) Vull.with pesticides. *Ann. Pl. Prot. Sci*.17 (1).

[6] Neves P.M, Hirose E, Tchujo P.T, Moino JR A.L. 2001.Compatibility of entomopathogenic fungi with neonicotinoid insecticides. *Neotrop. Ento*.. 30 (2):263-8.

[7] Purwar J.P, Sachan G.C. 2006.Synergistic effect of entomogenous fungi on some insecticides against Bihar hairy caterpillar *Spilarctiaobliqua* (Lepidoptera: Arctiidae). *Microbiol.Res*.161 (1):38-42

[8] Quintela E.D., Mc Coy C.W.1998. Synergistic effect of imidacloprid and two entomopathogenic fungi on the behavior and survival of larvae of *Diaprepesabbreviatus* (Coleoptera: Curculionidae) in soil. *J. Econ. Ento*. 91 (1):110-22.

[9] Serebrov V.V. Khodrev V.P. Gerber O.N. and Tsvetkova V.P. 2005. Perspectives of combined use of entomopathogenic fungi and chemical insecticides against Colorado beetle (*Leptinotarsadecemlineata*). *MikologiyaFitopatologiya*39 (3) 89-98

[10] Singh, S., R., K., Pandey and B., K. Goswami. 2013. Biocontrol activity of *Paecilomyceslilacinus* strains in managing root knot disease of tomato caused by *Meloidogyneincognita*. *Biocont. Sci Tech*. 23: 1469-1489