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Seed treatment with *Pseudomonas fluorescens*, plant products and synthetic insecticides against the leafhopper, *Amrasca devastans* (Distant) in cotton

N. Murugesan[1] and A.Kavitha

ABSTRACT

The present investigation was conducted to evaluate *Pseudomonas fluorescens* and neem oil alongwith eight synthetic insecticides such as, Acephate 75 SP, *Pseudomonas fluorescens*, carbosulfan 25 DS, carbosulfan 25 EC, dimethoate 30 EC, ethofenprox 10 EC, imidacloprid 17.8 SL, monocrotophos 36 SL, neem oil and phosalone 35 EC as seed treatments at 10 ml or gm per kg of seeds against *Amrasca devastans* in cotton. In the experiment conducted at the research farm, imidacloprid, monocrotophos and *P. fluorescens* were found to be effective in reducing the leafhopper population by more than 50 per cent. Imidacloprid was found to be the most effective treatment recording the least population of 0.8/3 leaves and was followed by monocrotophos (1.23/3 leaves) which was on par with *P. fluorescens* (1.42/3 leaves). All other treatments were unable to reduce the leafhopper population by less than 50 per cent. In another On Farm Trial (OFT) conducted at Thirupanikarisalkulam, leafhopper population appeared 10 DAS and increased steadily. All the seed treatments were able to reduce the leafhopper population. Imidacloprid was found to be the most effective one recording the least mean population of leafhoppers (0.53 /3 leaves). Imidacloprid and monocrotophos were able to reduce the leafhopper population by 72.54 and 59.59 per cent respectively. Other treatments *viz.*, acephate, *P. fluorescens*, phosalone, ethofenprox, dimethoate, neem oil, carbosulfan EC and carbosulfan DS resulted in less than 50 per cent reduction in leafhopper population compared to untreated check. Laboratory studies have shown that imidacloprid, monocrotophos and *P. fluorescens* improved germination and increased shoot length. Whereas neem oil had adverse effect on shoot length.

Key words: Seed treatment, *Pseudomonas fluorescens*, plant products, *Amrasca devastans*, cotton

INTRODUCTION

In India, 45 percent of the pesticides are applied (David, 2008) in cotton alone. Pesticide load in crop ecosystem has culminated in many undesirable effects such as resistance, resurgence, residues *etc.*, disturbing the agro-ecosystem. Sprays and soil application of pesticides are costly and cumbersome to adopt. So it is imperative to find out an ecofriendly and need based use of chemical pesticides as a component of integrated pest management (IPM). Seed treatment is an easy, economic and feasible method for pest control (Mote and Shah, 1993; Murugesan *et al.*, 2002; Murugesan and Annakkodi, 2007). It protects against insect pests and is eco-friendlier to bio control agents like coccinellids and chrysopids under field condition (Satpute, 1999, Murugesan *et al.*, 2002; Murugesan and Annakkodi, 2007). The aim of the present study was to evaluate seed treatment with antagonistic organisms botanicals and different insecticides, against the leafhopper, *Amrasca devastans* (Distant) in cotton.

MATERIALS AND METHODS

The efficacy of seed treatment with *Pseudomonas fluorescens*, neem oil and synthetic insecticides (Table 1) was evaluated in field experiments laid out in Randomised Block Design with eleven treatments – at Agricultural College and Research Institute (TNAU), Killikulam- as detailed below and were replicated thrice. The treatments were, T_1= Acephate (Asataf 75 SP®- O, S- dimethylacetyl phosphoroamidothioate -@10g / kg of seeds), T_2= *Pseudomonas fluorescens* (Pf- 1®- *Pseudomonas fluorescens* - @10g/ kg), T_3= Carbosulfan (Marshal 25DS®- 2,3- dihydro-2,2 – dimethyl-7- benzofuran-7-yl (dibutylaminothio) methylcarbamate- @10g/ kg), T_4= Carbosulfan (Marshal 25EC®- 2,3-dihydro-2,2-dimethyl-7-benzofuran –7-yl (dibutylaminothio) methylcarbamate- @10 ml / kg), T_5= Dimethoate (Rogor 30 EC®-0,0-dimethyl 1 S (N methyl carbomoyl methyl) phosphorodithioate- @10 ml / kg), T_6= Ethofenprox (Nukil (10EC®- 2-(4-ethoxyphenyl)-2-methylpropyl 3-phenoxybenzyl ether- @10 ml / kg), T_7= Imidacloprid (Confidor 17.8 SL®-1-(6-

chloronicotinyl)-2 nitroiminoimidazolidine- @10 ml / kg), T_8= Monocrotophos (Nuvacron 36SL®-Dimethyl (E)-1-methyl-2-(methyl carbamoyl) vinyl phosphate- @10 ml / kg), T_9=Neem oil (*Azadirachta indica* A. Juss. - @10 ml / kg), T_{10}= Phosalone (Zolone 35 EC®-S-6-Choloro-2,3 dihydro-2-oxobenzoxazolin-3 yl methyl 0,0-diethyl phosphorodithioate- @10 ml / kg), T_{11}= Untreated check. The acid delinted (concentrated sulphuric acid @ 100 ml kg^{-1} of seed) seeds were used for the experiments. To treat one kg of seed 0.5 g of *Acacia* gum powder and 20 ml of water were used. Gum was dissolved in water and mixed with the stipulated quantity of insecticides / plant products / antagonistic organisms. The seeds were thoroughly mixed with gum + insecticide mixture, dried under shade and kept for 24 hours before sowing. Untreated acid delinted seeds served as untreated check (UTC). The cultural operations were followed as envisaged in Crop Production Guide 2005 (Anonymous, 2005). Population of nymphs of *A. devastans* was recorded 10 DAS at ten days interval on ten randomly selected plants in each plot. In each plant three leaves - one each from top, middle and bottom strata- were observed and mean population per three leaves was worked out. The effect of seed treatments on seedling growth parameters was studied with Paper Towel method.

Statistical Analysis

The data gathered were transformed into angular or square-root values for statistical scrutiny, wherever necessary (Gomez and Gomez, 1984). The experiments were subjected to statistical scrutiny following the method of Panse and Sukhatme (1989) and Gomez and Gomez (1984) and the means were compared with Least Significant Difference (L.S.D.).

Table 1. Influence of seed treatment with different insecticides on the incidence of *A.devastans* (no./3 leaves) and its reduction over untreated check (ROVC)

Treatments	*A.devastans*	ROVC
Acephate 75 SP (10gm)	1.59^{cd}	46.64
Pseudomonas fluorescens PF1(10gm)	1.42^{bc}	53.34
Carbosulfan 25DS (10gm)	1.88^{de}	36.91
Carbosulfan 25EC (10ml)	1.88^{de}	36.91
Dimethoate 30 EC(10ml)	1.82^{cde}	38.93
Ethofenprox 10EC (10ml)	2.02^{de}	32.21
Imidacloprid 17.8 SL (10ml)	0.80^{a}	73.15
Monocrotophos 36SL (10ml)	1.23^{b}	57.72
Neem oil (10ml)	2.10^{e}	29.53
Phosalone 35 EC (10ml)	1.95^{de}	34.56
Untreated check	2.98^{f}	-
Mean	1.79	-

In a column, means followed by a common letter are not significantly different at 5% level (LSD).

RESULTS

The results of the experiments conducted with seed treatment with *Pseudomonas fluorescens*, neem oil and synthetic insecticides are presented below (Tables 1and 2).

Trial in Research Farm

Of the 10 seed treatments evaluated, imidacloprid, monocrotophos and *P. fluorescens* were found to be effective in reducing the leafhopper population by more than 50 per cent. Imidacloprid was found to be the most effective treatment recording the least population of 0.8/ 3 leaves and was followed by monocrotophos (1.23/3 leaves), which was on par with *P. fluorescens* (1.42/3 leaves) (Table 1).

On Farm Trial

In the on farm trial all the seed treatments were able to reduce the leafhopper population (Table 2). Imidacloprid was found to be the most effective recording the least mean population 0f 0.53 per three leaves. Imidacloprid and monocrotophos were able to reduce the leafhopper population by 72.54 and 59.59 per cent respectively. Other

Table 2. Influence of seed treatment with different insecticides on the incidence of *devastans* – (OFT)

Treatment	Leafhopper population (No./3leaves) untreated	Per cent reduction over check
Acephate 75 SP (10gm)	1.01^{c}	47.67
Pseudomonas fluorescens PF1 (10gm)	1.05^{cd}	45.60
Carbosulfan 25DS (10gm)	1.57^{f}	18.65
Carbosulfan 25EC (10ml)	1.32^{e}	31.61
Dimethoate 30 EC(10ml)	1.28^{e}	33.68
Ethofenprox 10EC (10ml)	1.24^{e}	35.75
Imidacloprid 17.8 SL (10ml)	0.53^{a}	72.54
Monocrotophos 36SL (10ml)	0.78^{b}	59.59
Neem oil (10ml)	1.34^{e}	30.57
Phosalone 35 EC (10ml)	1.19^{de}	38.34
Untreated check	1.93^{g}	-
Mean	1.20	-

In a column, means followed by a common letter are not significantly different at 5% level (LSD).

Table 3. Influence of seed treatment on germination and seedling growth parameters of cotton

Treatment	Germination (%)	+/- over untreated check (%)	Shoot length (cm)	+/- over untreated check (%)	Root length (cm)	+/- over untreated check (%)
Acephate 75 SP	63.40 cd	30.97	15.66bc	14.98	14.53b	22.72
P. fluorescens	69.11bc	42.78	15.15cd	11.23	14.38b	21.45
Carbosulfan 25DS	51.11efg	5.58	13.30f	-2.35	12.68cd	7.10
Carbosulfan 25EC	42.22 g	-12.79	13.17f	-3.30	11.39e	-3.80
Dimethoate 30 EC	48.88 efg	0.97	14.35de	5.36	13.11c	10.73
Ethofenprox 10EC	42.22 g	12.79	13.17f	-3.80	11.58e	-2.20
Imidacloprid 17.8 SL	82.42 a	70.25	17.40a	27.75	17.12a	44.60
Monocrotophos 36 WSC	74.36 b	53.61	16.44b	20.71	16.53a	39.61
Neem oil	42.97 fg	-11.24	10.68g	-21.59	11.46e	-3.21
Phosalone 35 EC	56.74 de	17.21	13.86e	1.76	11.70e	-1.18
Untreated check	48.41 efg	-	13.62ef	-	11.84e	-
Mean	56.53	-	14.23	-	13.30	-

In a column, means followed by a common letter are not significantly different at 5% level (LSD).

treatments *viz.*, acephate (1.01/3 leaves), *P. fluorescens* (1.05/3 leaves), phosalone (1.19/3 leaves), ethofenprox (1.24/3 leaves), dimethoate (1.28/3 leaves, neem oil (1.34/3 leaves), carbosulfan EC (1.32/3 leaves) and carbosulfan DS (1.57/3 leaves) resulted in less than 50 per cent reduction in leafhopper population compared to untreated check (1.93/3 leaves).

Germination and seedling growth parameters (Laboratory study)

Influence of seed treatments on germination, shoot length and root length was evident (Table 3). Imidacloprid recorded the highest germination (82.42%) and it was followed by monocrotophos (74.36%), which was on par with *P. fluorescens* (69.11%). Acephate (63.40%) was on par with *P. fluorescens.* Phosalone (56.74%), carbosulfan DS (51.11%), dimethoate (48.88%), carbosulfan EC (42.22%), ethofenprox (42.22%) and neem oil (42.97%) did not affected germination. Imidacloprid (17.40 cm) was the most effective treatment resulting in the longest shoots; monocrotophos (16.44cm) was the next best treatment; however, it was on par with acephate (15.66cm). *P. fluorescens* (15.15cm) equaled acephate and dimethoate (14.35cm). Dimethoate, phosalone (13.86cm), carbosulfan DS (13.30cm), carbosulfan EC (13.37cm) and ethofenprox (13.17cm) did not affected shoot length compared to untreated check (13.62cm). Neem oil reduced the shoot length by 21.59 per cent. Roots were longer with imidacloprid (17.12cm) and monocrotophos (16.53cm) seed treatments. Acephate (14.53 cm) and *P. fluorescens* (14.38cm) were the next best ones which were better than dimethoate (13.11cm) and carbosulfan DS (12.68cm) that were equal among themselves. Seed treatment with carbosulfan DS, phosalone (11.70cm), carbosulfan EC (11.39cm) and ethofenprox (11.58cm) did not affect germination.

DISCUSSION

Seed treatment with insecticides and plant products to manage crop pests is an alternative approach to minimize pesticide hazards. It has advantages such as, easy application, low cost, less pollution, selectivity and least interference in the natural equilibrium over soil or foliar application. Several earlier workers also reported better growth of the plants of imidacloprid 17.8 SL treated seeds in cotton (Dandale *et al.*, 2001; Gupta and Lal, 1998). Neem oil reduced the shoot length by 21.59 per cent. Such adverse effect on the interference of seed treatment on germination and seedling growth (Mitra *et al.*, 1970; Das and Chandrika , 1972; Murugesan. and Annakkodi, 2007) also available. The present study on the effectiveness of seed treatment with imidacloprid gain supports from earlier studies (Dandale *et al.*, 2001; Karabhantanal *et al.*, 2001). The present study brought out the effectiveness of *P. flourescens* as seed treatment, probably for the first time, against *A.devastans* on cotton. The mechanism of plant disease control by *P. fluorescens* like, production of antibiotics, siderophores, volatile compounds like HCN and ammonia, induction of systemic resistance and competition for nutrients (Muthusamy, 1999; Vidhyasekaran, 1999) may be the cause for the reduction in leafhopper population. Further studies are needed to find the exact reason for the effect of *P. flourescens* on cotton leafhopper.

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N. Murugesan[1] and A.Kavitha
[1]Cotton Research Station, TNAU, Srivilliputtur- 626 125, Tamil Nadu, India
[1]Communication author E-mail: n_murugeson@ yahoo.co.in.

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