Project Report

(September 2007 to February 2008)

IPM CRSP - Regional IPM Research and Education for South Asia - TNAU (INDIA)

Supported by: Virginia Tech, USA

Principal Investigators

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Tamil Nadu Agricultural University
Coimbatore – 641 003

2008

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Title of the Scheme : Regional IPM Research and Education for South Asia - TNAU (India)

Location : Department of Plant Molecular Biology and Biotechnology
Centre for Plant Molecular Biology & Biotechnology

Departments of Agricultural Entomology, Plant Pathology and Nematology
Centre for Plant Protection Studies
Tamil Nadu Agricultural University
Coimbatore – 641 003

Objectives :

1. Evaluation of transgenic eggplant with *cry2Aa* at green house for gene expression and efficacy against *Leucinodes orbonalis*
2. Conducting field trials at farmers field on integrated management of ESFB in eggplant and yellow vein mosaic virus in okra
3. Documentation of insecticide resistance and characterization of *Leucinodes orbonalis* and *Bemisia tabaci* populations using molecular tools.

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Progress of work done :

1. Testing EFSB (eggplant fruit and shoot borer) resistant eggplant in greenhouse and evaluation of gene expression in different stages and different plant parts

The resistant eggplant was tested in the greenhouse for gene expression in different stages (nursery, vegetative, flowering, fruiting and fag end of the crop) and different plant parts (leaves at different positions, main stem, flower, calyx, different aged fruits) and for efficacy against different instars of *Leucinodes orbonalis*. Totally, six transgenic plants (T_0) obtain under *in vitro* condition

were forwarded to greenhouse condition. T_0 selfed seed was used to raise T_1 nursery. The bioassay and expression study was carried out in T_0 and T_1 plants. After 30 days of sowing, the T_1 seedlings from line 1 to 6 along with control CO 2 were transplanted into separate pots.

Screening of putative transformants of brinjal plants for the expression of Cry2Aa gene by immunostrip assay

The immunostrips for detection of Cry2A protein were purchased from M/s Agdia Inc., USA, were used to verify the presence of Cry2Aa protein in extracts of leaf tissues from the putative transformants of brinjal plants (T1). Forty two plants of brinjal putative transformants were screened. None of the plants showed positive signal in the Cry2A immunostrip analysis. The strips were also tested by using the Cry2Aa and Cry2Ab proteins obtained from recombinant Bt strains.

Isolation of Cry2A proteins from recombinant Bt strains

Recombinant Bt strains were grown in T3 broth containing erythromycin (50µg/ml) till cell lysis. Spore-crystal mixtures were prepared by centrifugation. The spore-crystal mixtures obtained from the recombinant Bt strains were subjected to SDS-PAGE analysis. Production of Cry2A protein was obvious in the transformants of 4Q7 by the presence of a prominent band of ~ 65 kDa whereas such band was not found in control 4Q7.

Suspensions of crystal protein inclusion of Cry2Aa and Cry2Ab were tested at the concentration 20 ng/ µl. The Cry2A expression strips showed positive signal for immuno reaction in both Cry2Aa and Cry2Ab proteins.

Solubilization of Cry2A proteins

The Spore-crystal mixture isolated from the recombinant Bt strains were solubilized in 50mM NaOH. Pellet weight was calculated for spore-crystal mixture and solubilization buffer was added in 1:25 ratio [for 1 mg pellet: 25 µl of solubilization buffer mixed by vortexing and incubated at 37°C. After incubation the samples were centrifuged at 10,000 rpm for 10 min at 4 °C to remove the spores and undissolved inclusions from the supernatant.

Different concentrations (viz., 5 and 25 ng/µl) of alkali solubilized Cry2Aa and Cry2Ab proteins were tested by Cry2A immuno strips which again showed positive signal for the analysis.

Screening of brinjal transformants

Brinjal leaf extraction

Leaf bits were grinded by pestle and mortar along with the required volume of SEB4 buffer supplied along with the pack.

Tissue	Ratio for tissue to SEB4 buffer (fresh weight/volume – g/ml)	Example
Leaf	1:20	0.15g leaf: 3ml buffer

Test procedure

Two hundred micro litre of the leaf extract was taken for analysis. Bt-Cry2A Immunostrip was placed vertically into the eppendorf tube containing the extract. Care was taken to note that the ends of the strips immersed in the extract should be more than 0.5cm or ¼ inch. The end of the strip should remain in the extract during the course of the test.

Results

The control line appeared in less than 3 minutes. Maximum reaction should occur within 30 minutes at which the immunostrip was removed from the eppendorf tube containing the extract. For crude crystal protein suspension of Cry2Aa and Cry2Ab at the concentration of 20 ng/ µl and alkali solubilized proteins of Cry2Aa and Cry2Ab at the concentration of 5 and 25 ng/µl the test line was appeared in less than five minutes.

Forty two putative transformants of brinjal plants (T1) were used to verify the presence of Cry2Aa protein. The extracts of leaf tissue from putative transformants were prepared using sample extraction buffer (SEB4) and used for testing the presence of the Cry2Aa protein. Immuno reaction signal corresponding to Cry2A protein was not developed in the strips tested with all the forty two putative transformants of (T1) brinjal plants.

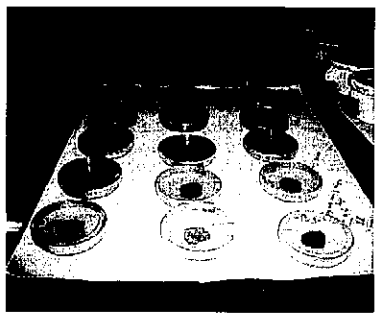
Screening of putative transformants of brinjal plants for the expression of Cry2Aa gene by bio assay

i. Leaf Bioassay

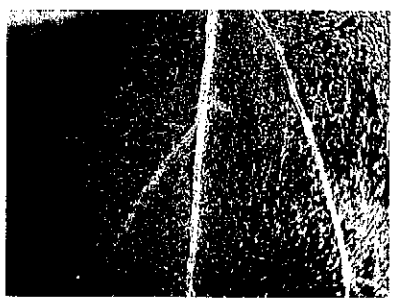
Bioassay was performed in sterile Petri dishes using leaf disc method. The bases of small, ventilated polythene Petri dishes (50 mm dia) were filled with agar gel (10g/litre, 5 ml). The leaf

discs were placed on the agar with their adaxial surface downwards. It was released with five numbers of larvae (depending upon the instar) and covered with lid. Observations were recorded at every 24 hours continuously for three days.

Leaf bioassay

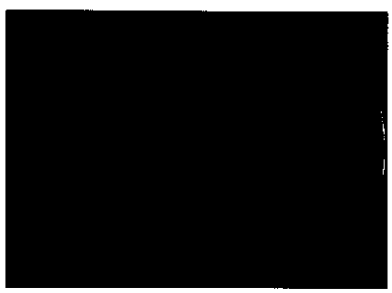


Leaf bioassay for Neonate larvae

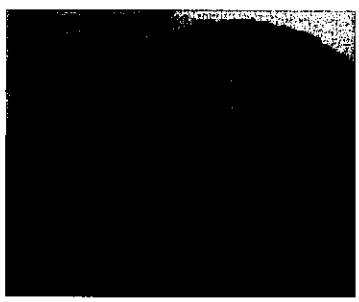


Leaf bioassay for II instar larvae

Leaf bioassay for III instar larvae



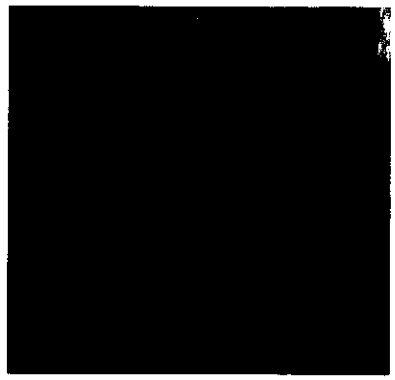
Leaf bioassay for IV instar larvae



ii. Shoot Bioassay

Bioassay was performed in sterile bioassay cups. A small twig of 15 cm was obtained from each plant of individual line from 1 to 6 was inserted in to 1 per cent agar gel. Five larvae (depending upon the instar) were released and covered with thicker gadda cloth. Observations were recorded at every 24 hours continuously for three days.

Shoot bioassay



Results

Table 1. Effect of Bt transgenic plants (T_0) at 60 DAS against neonates of *L. orbonalis*

Line No	Per cent mortality					
	after 24 hours		after 48 hours		after 72 hours	
	L	S	L	S	L	S
1	20	20	40	20	40	20
2	20	20	40	40	40	40
3	20	0	40	0	40	20
4	60	40	**100**	40	-	**100**
5	20	0	60	0	60	20
6	60	60	**100**	60	-	**100**

L- Leaf; S - Shoot

Fig 1. Effect of Bt transgenic plants (T1) at 30 DAS against neonates of *L. orbonalis*

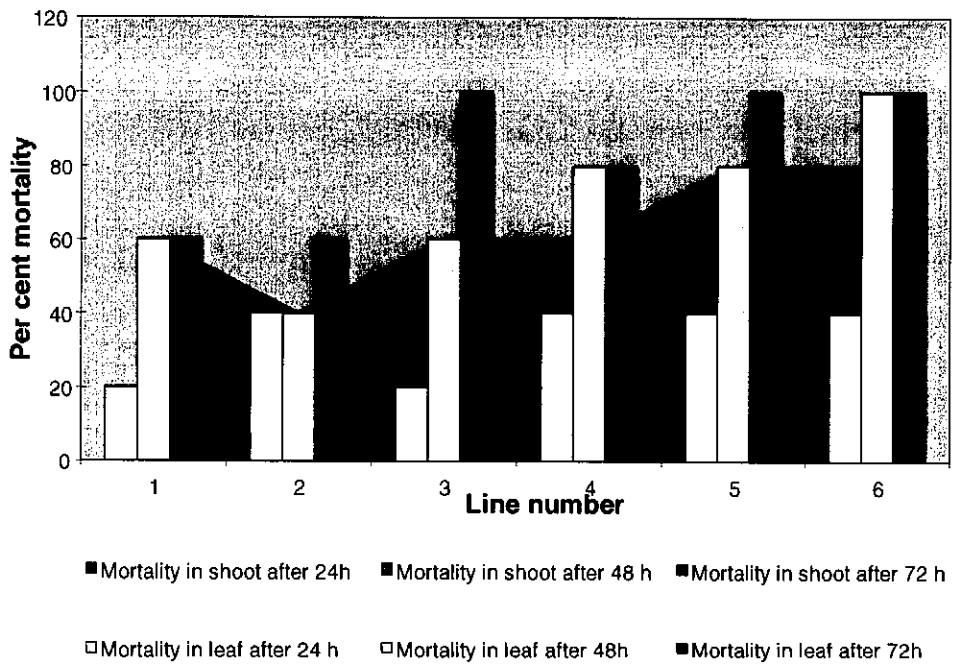


Table 2. Effect of Bt transgenic plants (T_1) on 60 DAS against neonates of *L. orbonalis*

Line No	Per cent mortality					
	After 24 hours		After 48 hours		After 72 hours	
	L	S	L	S	L	S
1	20	20	40	20	40	20
2	20	20	40	40	40	40
3	20	0	40	0	40	20
4	60	40	40	40	-	40
5	20	0	**100**	0	60	**80**
6	60	60	**100**	60	-	**100**

Table 3. Effect of Bt transgenic plants (T_1) at 90 DAS against neonates of *L. orbonalis*

Line No	Per cent mortality					
	After 24 hours		After 48 hours		After 72 hours	
	L	S	L	S	L	S
1	20	20	40	20	40	20
2	20	20	40	40	40	40
3	20	0	40	0	40	20
4	20	0	20	40	40	40
5	60	40	**100**	60	-	**80**
6	60	60	**100**	60	-	**100**

The results of the transgenic brinjal leaf and shoot (T_0) shows 100 per cent mortality in 4th and 6th line after 48 h of releasing the neonates of *L. orbonalis*, whereas in cent per cent mortality was noticed at 5th and 6th line of T_1 plants. Similarly, when the shoot and leaf bioassay was done with other intars, the maximum mortality ranged from 80 to 100 per cent on 5th and 6th lines of T_1 plants. Now the T_1 plants are under greenhouse condition.

II. Conducting field trials at farmers' field and studying integrated management of eggplant shoot and fruit borer in egg plant and yellow vein mosaic virus in okra with cultural methods, botanicals and biopesticides and comparing them with farmers practice.

The effect of various IPM practices was studied against insect pests, diseases and nematodes in brinjal and bhendi. Therefore four field trials with two each in brinjal and bhendi was conducted at Kollupatti, Dharmapuri district during August 2007 – February 2008 and one brinjal trial at Theethipalayam, Coimbatore district.

Hybrid/Variety used

S. No	Location	Crop	Name of the hybrid/variety
1.	Kollupatti, Dharmapuri Dt	Trial I -Brinjal	Mohini hybrid
2.	Kollupatti, Dharmapuri Dt	Trial II- Brinjal	Mohini hybrid
3.	Kollupatti, Dharmapuri Dt	Trial I - Bhendi	US agriseeds 7109 hybrid
4.	Kollupatti, Dharmapuri Dt	Trial II- Bhendi	US agriseeds 7109 hybrid
5.	Theethipalayam, Coimbatore Dt.	Brinjal	CO 2 variety

Brinjal

Raising nursery

The soil was solarised by covering with 0.1 mm thick transparent polyethylene sheet for six weeks. Before covering with sheets, the soil was under moist condition. After six weeks, the *Pseudomonas fluorescens* treated seeds were sown over the solarised soil. Along with treated, untreated seed was also sown for raising control plots. Once in every three days, the seedlings were observed for the incidence of insect pests, pathogens and nematodes.

Transplanting

The experiment was conducted in Randomized Block Design with seven treatments and three replications in bhendi and nine treatments and three replications in brinjal. The treatments followed are given below.

Materials and Methods

The treatments used in bhendi are given below.

T_1	IPM (Seed treatment with *Pseudomonas fluorescens* (2g/kg) + soil application of neem cake (200kg/acre)+ foliar spray of fish oil rosin soap 2% + foliar spray of NSKE 5%+ Yellow sticky trap)
T_2	IPM minus Seed treatment with *Pseudomonas fluorescens* (10g/ kg)
T_3	IPM minus Soil Application of Neem cake (400 kg/ ha)
T_4	IPM minus Yellow sticky trap (1kg/acre)
T_5	IPM minus Neem Seed Kernal Extract (5%) (NSKE)
T_6	IPM minus Fish oil rosin soap (2 %)
T_7	Farmers practice

Along with these treatments, additionally, two treatments were included *ie.*, IPM minus *Trichogramma chilonis* and IPM minus Intercropping (Coriander) in brinjal trial.

Time of application

Neem cake (200 kg/acre) was applied in the soil at the time of last ploughing. The yellow sticky bands were placed in the main field, when the plants were at a height of 20cm. Three sprays of fish oil rosin soap (2 per cent) and Neem Seed Kernel Extract (5 per cent) were given 20 days after sowing and repeated on 40 and 60 DAS in bhendi and two more additional sprays are given for brinjal trial on 80 and 100 DAT. Coriander sowing was undergone during sowing / planting of main crop.

Observations

Insect pests

The per cent damage caused by shoot and fruit borer and the number of mites were recorded. In brinjal, the shoot damage caused by *L. orbonalis* was recorded at 10 days interval and the fruit damage and mite incidence was recorded at every 15 days by observing 15 plants selected at random in all the replications. In bhendi, the incidence whitefly and mite incidence was recorded at every 10 days interval.

Diseases

The observations on Per cent Disease Incidence for wilt and Per cent Disease Index (PDI) for foliar diseases were recorded. In Okra, the intensity of the diseases was recorded at 10 days interval by observing 15 plants selected at random in each treatment in all the replications whereas in Brinjal

the disease intensity was recorded at 30 days interval. For foliar disease intensity of the disease was recorded in 15 leaves selected at random in each treatment following the score chart 0-9 scale (Mayee and Datar, 1986) and the Per cent Disease Index was calculated by Mc Kinney (1923) formula.

Nematodes

Observations on soil population of root-knot nematode *Meloidogyne incognita* in 250cc soil was taken at 30 days interval upto 120 days for brinjal and 10 days interval upto 60 days for okra and gall index at the time of termination of the experiment for both the crops were recorded.

Results

The results of various treatments on the incidence of insects, diseases and nematodes of brinjal are given below.

Insect Pests

Brinjal

Considering the location, overall damage of eggplant shoot and fruit borer (ESFB) and incidence of mites was maximum at Dharmapuri field trials. Considering the incidence of insect pests, the maximum ESFB damage and mite incidence was observed on farmers practice, while the minimum damage and incidence was observed in the plot imposed with integrated pest management practices.

Eggplant shoot and fruit borer, *Leucinodes orbonalis*

Considering the brinjal field trial at Dharmapuri district, the maximum shoot and fruit damage of EFSB (23 and 58.12 per cent) was observed on 30 and 90 DAT at farmers plot in trial II compared to trial I with 1 per cent and 19 per cent damage on 10 and 120 DAT in plot with IPM practices (Table 2, 3, 5 and 6).

Considering the treatment effects other than farmers field, the maximum damage was observed in the plot with IPM minus *Trichogramma chilonis* in EFSB management. The second maximum damage was observed in the plot with IPM minus intercropping, which proves that intercropping also plays major role in *L. orbonalis* management.

Considering the Coimbatore trial, the maximum damage (29.00 per cent) was observed in farmers field on 30 DAT, while the least shoot damage (2.00 per cent) was observed in plot with IPM practices (Table 1). The maximum friuit damage (73.14 per cent) was observed in plot with farmers practices. The maximum fruit damage (73.14 per cent) was observed on 75 DAT in plot with farmers practice than on damage (19.00 per cent) at 90 DAT in plot with IPM practices (Table 4).

Mite: *Tetranychus* spp.

The mite incidence was observed in the later stages of the cropping period. However the maximum number was observed in trial II than trial I. Considering the trial I, the maximum number (5/sq cm) was observed in farmers plot without IPM practices and there was no incidence in all the treatments on the 45 DAT (Table 12 and 13).

Considering the trial II, the maximum number (6 / sq cm) was observed in farmers field while there was no mite incidence at 30 DAT on plot with IPM practices. Considering the Theethipalayam field trial, the maximum number (5/sq. cm) was observed in farmers field and the minimum number (1 number/sq cm) was observed in plot with IPM practices. When considering the treatment effects other than farmers field, the maximum damage was observed in IPM plot minus NSKE 5% in all the three field trials (Table 11).

Bhendi

Whiteflies

On the whole, the incidence at Dharmapuri was maximum when compared to Coimbatore. The incidence of whiteflies was maximum observed during the initial stages of the cropping period. It was higher on the 60 DAS in all the treatments of both the trials. Considering the trial I, maximum incidence of 5 number per plant on 60 DAS was recorded on the farmers plot without IPM, while there was no incidence on IPM plot on 30 DAS. When considering other treatments, incidence was more (3 number per plant) in three treatments like IPM minus yellow sheet, IPM minus NSKE5% and IPM minus fish oil rosin soap 2 per cent (Table 7).

Similarly, in trial II at Dharmapuri district, the maximum (6 number per plant) was observed in farmers practice and there was no whiteflies in IPM plot on 30 DAS (Table 8). However, the incidence at trial II was comparatively higher than trial I. Though the IPM plot was found to have minimum number of whiteflies, the plot with all IPM components except fish oil rosin soap 2 per cent showed maximum incidence (4 number per plant) on 30, 40 and 50 DAS. The same pest load was observed in IPM minus neem seed kernel extract 5 per cent and IPM minus yellow sheet on 40 DAS. So, this result indicated that NSKE, yellow sheet and fish oil rosin soap plays major role in whitefly management.

Mite

The incidence of mite was seen maximum in the later stages of the cropping period. Maximum of 6 number per sq.cm was observed in the plot with farmers practices on 60 DAS in trial II while there was no incidence in plot with IPM practices. Similar trend (increasing population with increase in cropping period) of pest load was seen in trial I (Table 9 and 10).

Table 1. Effect of various treatments on the damage of *L. orbonalis* in shoot of brinjal CO2 variety (Theethipalayam, Coimbatore, Aug. 2007 – March 2008) - Farmer's name: Mrs. Suseela

S. No	Treatments	Damage of *L. orbonalis* at indicated days after planting					
		10 DAT	20 DAT	30 DAT	40 DAT	50 DAT	Mean
1.	IPM	2.00 (8.08)	5.61 (13.70)	4.72 (12.55)	3.12 (10.17)	2.25 (8.61)	3.54 (10.63)
2.	IPM minus *P. fluorescens*	4.00 (11.52)	6.27 (14.50)	5.22 (13.20)	4.00 (11.48)	3.10 (10.09)	4.52 (12.16)
3.	IPM minus Neem cake	5.12 (13.08)	6.50 (14.76)	5.65 (13.68)	4.60 (12.37)	3.90 (11.38)	5.20 (13.05)
4.	IPM minus Yellow sheet	4.50 (12.23)	5.52 (13.58)	5.30 (13.30)	4.91 (12.80)	4.80 (12.61)	5.01 (12.61)
5.	IPM minus NSKE 5%	9.00 (17.39)	18.21 (25.25)	19.65 (26.28)	15.70 (23.32)	14.83 (22.59)	15.48 (12.91)
6.	IPM minus FORS 2%	7.00 (15.24)	14.00 (21.88)	13.12 (21.24)	10.13 (18.56)	9.18 (17.60)	10.69 (22.97)
7.	IPM minus *Trichogramma chilonis*	9.80 (18.24)	17.92 (25.26)	22.70 (28.45)	16.21 (23.74)	14.22 (23.35)	16.17 (18.91)
8.	IPM minus Intercropping	9.20 (17.65)	19.20 (25.98)	21.60 (27.69)	18.20 (25.25)	16.21 (23.71)	16.88 (23.81)
9.	Farmers practice	12.40 (20.62)	24.00 (24.82)	29.30 (32.77)	24.00 (29.33)	23.00 (28.63)	22.54 (24.06)
	Mean	7.00 (14.90)	13.03 (19.97)	14.14 (21.02)	11.21 (18.96)	10.17 (17.62)	11.11 (18.41)
	CD: T= 2.53, D=1.89 T x D= 5.66						

Mean of five replications
Figures within parentheses are arc sine transformed values.
DAT- Days after planting

Table 2. Effect of various treatments on the damage of *L. orbonalis* in shoot of brinjal Mohini hybrid (Trial 1- Kollupatti, Dharmapuri, Aug, 2007- March 2008) Farmer name: Thiru. Ravi

S. No	Treatments	Damage of *L. orbonalis* at indicated days after planting					
		10 DAT	20 DAT	30 DAT	40 DAT	50 DAT	Mean
1.	IPM	1.00 (5.05)	2.12 (8.37)	3.71 (11.07)	2.75 (9.52)	1.40 (6.62)	2.20 (8.13)
2.	IPM minus *P. fluorescens*	3.00 (9.88)	5.00 (12.88)	4.22 (11.80)	3.00 (9.88)	2.75 (9.54)	3.60 (10.80)
3.	IPM minus Neem cake	4.32 (11.99)	5.50 (13.53)	4.80 (12.63)	3.60 (10.93)	2.92 (9.74)	4.23 (11.76)
4.	IPM minus Yellow sheet	3.71 (11.03)	4.72 (12.50)	5.00 (12.77)	4.00 (11.48)	4.10 (11.63)	4.30 (11.88)
5.	IPM minus NSKE 5%	7.62 (16.00)	14.21 (22.14)	12.12 (20.36)	12.79 (20.95)	10.00 (18.42)	11.35 (19.57)
6.	IPM minus FORS 2%	5.00 (12.49)	11.19 (19.53)	11.00 (19.35)	7.00 (15.24)	7.72 (16.11)	8.38 (16.55)
7.	IPM minus *Trichogramma chilonis*	8.00 (15.51)	14.00 (21.94)	18.00 (25.02)	12.00 (20.23)	7.00 (12.86)	11.80 (19.11)
8.	IPM minus Intercropping	6.00 (11.90)	14.20 (22.11)	17.92 (25.04)	14.00 (21.94)	14.00 (21.97)	13.44 (20.59)
9.	Farmers practice	11.00 (19.32)	20.00 (27.25)	21.11 (28.65)	18.00 (24.99)	15.00 (24.35)	17.02 (24.91)
	Mean	7.00 (12.58)	13.03 (17.81)	14.14 (18.52)	11.21 (16.13)	10.17 (14.58)	11.11 (15.92)
	CD (0.05): T=2.49 , D=1.86 TxD=5.57						

Mean of five replications
Figures within parentheses are arc sine transformed values.
DAT- Days after planting

Table 3. Effect of various treatments on the damage of *L. orbonalis* in Shoot of brinjal Mohini hybrid (Trial II- Kollupatti, Dharmapuri, August 2007- March 2008) – Farmer's name: Thiru. Dhamodaran

S. No	Treatments	Damage of *L. orbonalis* at indicated days after planting					
		10 DAT	20 DAT	30 DAT	40 DAT	50 DAT	Mean
1.	IPM	2.00 (6.98)	3.45 (10.70)	4.00 (11.28)	3.00 (9.55)	2.00 (7.95)	2.89 (9.29)
2.	IPM minus *P. fluorescens*	3.15 (10.22)	5.27 (13.27)	4.67 (12.43)	3.33 (10.16)	3.00 (9.97)	3.88 (11.21)
3.	IPM minus Neem cake	4.61 (12.40)	5.72 (13.84)	4.92 (12.82)	3.75 (11.15)	3.21 (10.32)	4.44 (12.10)
4.	IPM minus Yellow sheet	3.92 (11.42)	4.99 (12.87)	5.20 (13.12)	4.21 (11.83)	4.40 (12.10)	4.54 (12.27)
5.	IPM minus NSKE 5%	8.00 (16.43)	16.00 (23.11)	15.32 (23.01)	14.00 (21.94)	11.00 (19.36)	12.86 (20.77)
6.	IPM minus FORS 2%	5.52 (13.55)	12.00 (20.26)	12.15 (20.39)	8.15 (16.58)	8.00 (16.43)	9.16 (17.44)
7.	IPM minus *Trichogramma chilonis*	9.00 (17.44)	16.00 (23.55)	19.20 (25.97)	13.12 (21.27)	8.00 (16.34)	13.06 (20.91)
8.	IPM minus Intercropping	7.00 (15.24)	16.21 (23.72)	18.24 (25.26)	10.20 (18.57)	11.22 (19.56)	12.57 (20.47)
9.	Farmers practice	11.00 (19.32)	21.00 (28.65)	23.00 (28.65)	20.00 (30.55)	17.00 (24.33)	18.40 (26.30)
	Mean	6.02 (13.67)	11.18 (18.88)	11.86 (19.22)	8.86 (16.84)	7.54 (15.15)	11.11 (16.75)
	CD (0.05): T=1.58 , D=1.17 TxD=3.53						

Mean of five replications
Figures within parentheses are arc sine transformed values.
DAT- Days after transplanting

Table 4. Effect of various treatments on the damage of *L. orbonalis* in fruits of brinjal CO2 (Theethipalayam, Coimbatore, August 2007- March, 2008) Farmer's name – Mrs. Suseela)

S. No	Treatments	Damage of *L. orbonalis* at indicated days after planting						
		30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	120 DAT	Mean
1.	IPM	20.20 (26.69)	21.00 (27.26)	22.20 (28.10)	20.00 (24.99)	19.00 (25.82)	19.90 (26.48)	2.89 (26.56)
2.	IPM minus *P. fluorescens*	25.00 (25.43)	24.10 (29.39)	23.10 (28.71)	25.20 (30.12)	24.00 (24.82)	24.00 (28.82)	3.88 (27.88)
3.	IPM minus Neem cake	27.00 (31.30)	24.00 (29.33)	22.10 (28.03)	23.70 (25.68)	23.00 (28.65)	25.00 (29.22)	4.44 (28.70)
4.	IPM minus Yellow sheet	26.20 (30.78)	24.30 (29.53)	25.00 (30.00)	26.00 (26.03)	23.00 (28.66)	24.00 (29.32)	4.54 (29.05)
5.	IPM minus NSKE 5%	38.21 (38.18)	37.00 (37.46)	39.10 (38.70)	36.81 (37.34)	38.91 (38.59)	37.00 (37.46)	12.86 (37.96)
6.	IPM minus FORS 2%	20.92 (27.22)	21.10 (27.33)	22.40 (28.23)	24.00 (24.82)	23.00 (28.66)	23.10 (28.70)	9.16 (27.49)
7.	IPM minus *Trichogramma chilonis*	39.56 (38.97)	40.00 (38.85)	38.10 (38.11)	39.21 (38.77)	39.00 (38.65)	37.00 (37.46)	13.06 (38.47)
8.	IPM minus Intercropping	9.67 (39.04)	39.00 (38.63)	41.02 (39.83)	40.00 (39.06)	37.00 (37.46)	36.00 (36.87)	12.57 (38.48)
9.	Farmers practice	58.10 (49.70)	63.10 (52.60)	72.10 (58.13)	73.14 (58.80)	62.12 (52.02)	55.70 (48.28)	18.40 (53.25)
	Mean	29.43 (34.14)	32.62 (34.49)	33.90 (35.32)	34.23 (33.96)	32.11 (33.70)	31.3 (33.62)	9.09 (34.20)
	CD (0.05): T=4.87, D= 3.98, TxD=11.93							

Mean of five replications
Figures within parentheses are arc sine transformed values.
DAT- Days after transplanting

Table- 5. Effect of various treatments on the damage of *L. orbonalis* in fruits of brinjal Mohini hybrid (Trial I Kollupatti, Dharmapuri, August 2007- March, 2008) (Farmer - Thiru. Ravi)

S. No	Treatments	Damage of *L. orbonalis* at indicated days after planting						
		30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	120 DAT	Mean
1.	IPM	21.00 (26.70)	20.20 (27.26)	20.10 (28.10)	20.00 (24.99)	19.00 (25.82)	19.10 (26.48)	80.18 (26.56)
2.	IPM minus *P. fluorescens*	22.00 (25.43)	23.10 (29.39)	24.10 (28.71)	24.20 (30.12)	23.00 (24.82)	20.00 (28.82)	22.73 (27.88)
3.	IPM minus Neem cake	24.00 (31.30)	22.10 (29.33)	24.00 (28.028)	23.00 (25.68)	22.00 (28.65)	22.00 (29.22)	22.85 (28.70)
4.	IPM minus Yellow sheet	24.30 (30.78)	21.20 (29.53)	26.00 (30.00)	25.00 (26.03)	22.00 (28.66)	23.00 (29.32)	23.58 (29.05
5.	IPM minus NSKE 5%	37.00 (38.18)	38.21 (37.46)	38.00 (38.70)	36.00 (37.34)	38.00 (38.59)	36.00 (37.46)	37.20 (37.96)
6.	IPM minus FORS 2%	21.00 (27.22)	20.92 (27.33)	20.10 28.23)	22.00 (24.82)	21.00 (28.66)	21.10 (28.70)	21.02 (27.49)
7.	IPM minus *Trichogramma chilonis*	39.00 (38.97)	39.56 (38.86)	37.20 (38.11)	38.00 (38.77)	37.00 (38.65)	35.26 (37.46)	37.67 (38.47)
8.	IPM minus Intercropping	39.00 (39.04)	37.61 (38.63)	39.20 (39.83)	39.00 (39.06)	35.10 (37.46)	35.91 (36.87)	37.64 (38.48)
9.	Farmers practice	32.10 (49.67)	39.12 (52.60)	43.71 (58.13)	45.55 (58.80)	58.12 (52.02)	32.17 (48.28)	41.80 (53.24)
	Mean	24.49 (34.14)	29.11 (34.49)	30.27 (35.32)	30.31 (33.96)	30.58 (33.70)	27.17 (33.62)	36.07 (34.20)
	CD (0.05): T=4.87, D=3.98, TxD=11.93							

Mean of five replications
Figures within parentheses are arc sine transformed values.
DAT- Days after transplanting

Table- 6. Effect of various treatments on the damage of *L. orbonalis* in fruits of brinjal Mohini hybrid (Trial – II, Kollupatti, Dharmapuri, August 2007- March, 2008) (Farmer - Thiru. Dhamodaran)

S. No	Treatments	Damage of *L. orbonalis* at indicated days after planting						
		30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	120 DAT	Mean
1.	IPM	21.00 (27.28)	19.75 (26.37)	20.20 (26.69)	19.25 (26.01)	20.21 (26.70)	19.00 25.82)	19.90 (26.48)
2.	IPM minus *P. fluorescens*	23.00 (28.65)	25.10 (30.06)	23.10 (28.70)	24.10 (29.35)	23.00 (24.22)	22.00 (27.97)	23.38 (28.16)
3.	IPM minus Neem cake	25.00 (25.43)	24.00 (29.33)	22.15 (28.06)	23.10 (28.73)	24.00 (29.33)	23.00 (28.63)	23.54 (28.25)
4.	IPM minus yellow sheet	25.20 (30.13)	26.20 (30.78)	26.00 (30.56)	24.00 (24.82)	27.00 (31.30)	25.00 (30.00)	25.57 (29.60)
5.	IPM minus NSKE 5%	28.00 (38.05)	37.10 (37.52)	38.00 (38.05)	38.10 (38.12)	37.00 (37.47)	36.00 (36.87)	35.70 (37.69)
6.	IPM minus FORS 2%	20.90 (27.19)	22.00 (27.96)	21.00 27.27)	19.90 (26.48)	22.30 (28.18)	20.00 (22.36)	21.02 (26.57)
7.	IPM minus *Trichogramma chilonis*	39.56 (38.97)	40.00 (38.86)	41.00 (39.82)	41.00 (39.44)	39.00 (38.65)	38.00 (38.06)	39.76 (38.97)
8.	IPM minus Intercropping	34.61 (36.03)	37.00 (37.46)	35.00 (36.24)	36.10 (36.93)	35.10 (36.33)	34.00 (35.65)	35.30 (36.44)
9.	Farmers practice	38.12 (38.12)	45.20 (42.25)	47.12 (43.35)	48.12 (43.92)	58.12 (49.68)	38.00 (38.05)	45.78 (42.56)
	Mean	28.38 (32.21)	30.71 (33.40)	30.40 (33.20)	30.40 (32.64)	31.75 (33.54)	28.33 (31.49)	29.99 (32.74)
	CD (0.05): T=4.21, D=3.44, TxD=10.32							

Mean of five replications
Figures within parentheses are arc sine transformed values.
DAT- Days after transplanting

Table 7. Effect of various treatments on the incidence of whiteflies in bhendi US agriseeds 7109 hybrid (Trial I- Kollupatti, Dharmapuri district, August 2007- Nov 2007) (Farmer - Thiru. Ravi)

S. No	Treatments	Number of whiteflies at indicated days after sowing				
		30 DAS	40 DAS	50 DAS	60 DAS	Mean
1.	IPM	0 (0.71)	1 (1.22)	1 (1.10)	0 (0.71)	0.50 (0.93)
2.	IPM minus *P. fluorescens*	1 (1.17)	2 (1.58)	1 (1.22)	1 (1.10)	1.25 (1.27)
3.	IPM minus Neem cake	1 (1.17)	2 (1.50)	1 (1.17)	1 (1.17)	1.25 (1.25)
4.	IPM minus Yellow sheet	4 (2.11)	5 (2.34)	3 (1.87)	2 (1.50)	3.50 (1.95)
5.	IPM minus NSKE 5%	2 (1.58)	2 (1.56)	1 (1.22)	2 (1.50)	1.75 8(1.46)
6.	IPM minus FORS 2%	4 (1.91)	3 (1.87)	3 (1.79)	2 (1.50)	3.00 (1.76)
7.	Farmers practice	6 (2.50)	6 (2.26)	4 (1.91)	3 (1.62)	4.75 (2.07)
	Mean	2.57 ()	3.00 ()	2.00 ()	1.57 ()	2.29 (1.53)
	CD (0.05): T=0.49, D=0.37, TxD=0.98					

Mean of five replications
Figures within are square root transformed values.
DAS- Days after sowing

Table 8. Effect of various treatments on the incidence of whiteflies in bhendi US agriseeds 7109 hybrid (Trial II- Kollupatti, Dharmapuri district, August 2007- Nov 2007)
Farmer name: Thiru. Dhamodaran

S. No	Treatments	Number of whiteflies at indicated days after sowing				
		30 DAS	40 DAS	50 DAS	60 DAS	Mean
1.	IPM	1 (0.71)	1 (1.17)	1 (1.22)	1 (0.71)	0.50 (0.95)
2.	IPM minus *P. fluorescens*	2 (1.17)	2 (1.58)	1 (1.10)	1 (1.22)	1.25 (1.27)
3.	IPM minus Neem cake	2 (1.10)	3 (1.48)	2 (1.22)	1 (1.17)	1.25 (1.24)
4.	IPM minus Yellow sheet	5 (2.11)	5 (2.10)	4 (1.86)	2 (1.56)	3.50 (1.91)
5.	IPM minus NSKE 5%	3 (1.55)	3 (1.56)	2 (1.22)	1 (1.47)	1.75 (1.45)
6.	IPM minus FORS 2%	4 (2.11)	5 (1.86)	4 (1.84)	4 (1.47)	3.00 (1.82)
7.	Farmers practice	7 (2.50)	8 (2.43)	7 (2.11)	6 (1.84)	4.75 (2.22)
	Mean	2.57 (1.61)	3.00 (1.74)	2.00 (1.51)	1.57 (1.35)	2.29 (1.60)
	CD (0.05): T=0.41 , D=0.31 , TxD=0.81					

Mean of five replications
Figures within are square root transformed values.
DAS- Days after sowing

Table 9. Effect of various treatments on the incidence of mite (sq/cm) in bhendi US agriseeds 7109 hybrid (Trial I - Kollupatti, Dharmapuri district, Aug. 2007- February 2008) Farmer name: Thiru. Ravi

S. No	Treatments	Number of mite/sq m at indicated days after sowing				
		30 DAS	40 DAS	50 DAS	60 DAS	Mean
1.	IPM	0 (0.71)	1 (1.22)	2 (1.56)	3 (1.71)	1.50 (1.30)
2.	IPM minus *P. fluorescens*	1 (1.17)	2 (1.47)	2 (1.47)	2 (1.32)	1.75 (1.36)
3.	IPM minus Neem cake	0 (0.71)	2 (1.58)	2 (1.58)	2 (1.52)	1.50 (1.35)
4.	IPM minus Yellow sheet	2 (1.52)	2 (1.47)	2 (1.58)	3 (1.87)	2.25 (1.61)
5.	IPM minus NSKE 5%	1 (1.22)	3 (1.87)	3 (1.50)	3 (1.71)	2.50 (1.58)
6.	IPM minus FORS 2%	2 (1.47)	3 (1.87)	3 (1.71)	3 (1.84)	2.75 (1.72)
7.	Farmers practice	3 (1.87)	3 (1.86)	4 (2.12)	5 (2.34)	3.75 (2.05)
	Mean	1.29 (1.24)	2.29 (1.62)	2.57 (1.65)	3.00 (1.76)	2.18 (1.57)
	CD (0.05): T= 0.44 , D=0.33, TxD= 0.88					

Mean of five replications
Figures within are square root transformed values.
DAS- Days after sowing

Table 10. Effect of various treatments on the incidence of mite (sq/cm) in bhendi US agriseeds 7109 hybrid (Trial II- Kollupatti, Dharmapuri district, Aug. 2007- Feb. 2008)
Farmer name: Thiru. Dhamodaran

S. No	Treatments	Number of mite/sq.m at indicated days after sowing				
		30 DAS	40 DAS	50 DAS	60 DAS	Mean
1.	IPM	0 (0.71)	2 (1.56)	2 (1.56)	2 (1.58)	1.50 (1.35)
2.	IPM minus *P. fluorescens*	2 (1.47)	3 (1.71)	3 (1.50)	4 (1.91)	3.00 (1.65)
3.	IPM minus Neem cake	1 (1.22)	3 (1.85)	3 (1.87)	3 (1.81)	2.50 (1.69)
4.	IPM minus Yellow sheet	3 (1.84)	3 (1.50)	4 (2.12)	4 (2.11)	3.50 (1.89)
5.	IPM minus NSKE 5%	3 (1.87)	3 (1.81)	3 (1.73)	4 (2.12)	3.25 (1.88)
6.	IPM minus FORS 2%	4 (2.12)	4 (1.83)	4 (1.96)	4 (2.11)	4.00 (2.00)
7.	Farmers practice	4 (2.11)	4 (1.90)	4 (2.12)	6 (2.54)	4.50 (2.17)
	Mean	2.43 (1.62)	3.14 (1.74)	3.29 (1.84)	3.86 (2.03)	3.18 (1.81)
	CD (0.05): T= 0.61, D=0.46, TxD=1.22					

Mean of five replications
Figures within are square root transformed values.
DAS- Days after sowing

Table 11. Effect of various treatments on the incidence of mite (sq/cm) in brinjal Mohini hybrid (Theethipalayam, Coimbatore district, August 2007- Feb, 2008) (Farmer – Mrs. Suseela)

S. No	Treatments	Number of mite/sq m at indicated days after planting					
		45 DAT	60 DAT	75 DAT	90 DAT	120 DAT	Mean
1.	IPM	1 (1.22)	2 (1.32)	2 (1.47)	2 (1.48)	2 (1.58)	1.80 (1.42)
2.	IPM minus *P. fluorescens*	2 (1.58)	2 (1.58)	2 (1.48)	3 (1.71)	3 (1.50)	2.40 (1.57)
3.	IPM minus Neem cake	2 (1.58)	2 (1.58)	2 (1.58)	2 (1.48)	3 (1.71)	2.20 (1.59)
4.	IPM minus Yellow sheet	2 (1.58)	3 (1.71)	3 (1.50)	4 (2.08)	3 (1.86)	3.00 (1.75)
5.	IPM minus NSKE 5%	2 (1.58)	4 (2.08)	4 (2.12)	4 (2.11)	4 (2.02)	3.60 (1.99)
6.	IPM minus FORS 2%	2 (1.58)	2 (1.47)	4 (2.11)	4 (2.11)	4 (2.12)	3.20 (1.88)
7.	IPM minus *Trichogramma chilonis*	2 (1.58)	2 (1.56)	1 (1.10)	2 (1.32)	2 (1.47)	1.80 (1.41)
8.	IPM minus Intercropping	2 (1.58)	2 (1.58)	2 (1.47)	2 (1.32)	2 (1.48)	2.00 (1.49)
9.	Farmers practice	4 (1.91)	4 (2.11)	4 (2.12)	5 (2.10)	5 (2.35)	4.40 (2.19)
	Mean	2.11 (1.58)	2.56 (1.67)	2.67 (1.66)	3.11 (1.75)	3.11 (1.79)	2.71 (1.69)
	CD (0.05): T=0.41, D= 0.30, TxD=0.91						

Mean of five replications
Figures within are square root transformed values.
DAT- Days after transplanting

Table12. Effect of various treatments on the incidence of mite (sq/cm) in brinjal Mohini hybrid (Trial I - Kollupatti, Dharmapuri district, August 2007- Feb, 2008)
Farmer's name: Thiru. Ravi

S. No	Treatments	Number of mite/sq m at indicated days after transplanting					
		45 DAT	60 DAT	75 DAT	90 DAT	120 DAT	Mean
1.	IPM	0 (0.71)	1 (1.22)	1 (1.17)	2 (1.58)	2 (1.47)	1.20 (1.23)
2.	IPM minus *P. fluorescens*	0 (0.71)	1 (1.22)	2 (1.58)	2 (1.48)	2 (1.58)	1.40 (1.32)
3.	IPM minus Neem cake	0 (0.71)	1 (1.22)	1 (1.22)	2 (1.58)	2 (1.48)	1.20 (1.24)
4.	IPM minus Yellow sheet	0 (0.71)	2 (1.47)	2 (1.52)	2 (1.32)	2 (1.47)	1.60 (1.29)
5.	IPM minus NSKE 5%	0 (0.71)	2 (1.58)	2 (1.48)	2 (1.32)	2 (1.48)	1.60 (1.32)
6.	IPM minus FORS 2%	0 (0.71)	1 (1.22)	2 (1.58)	2 (1.58)	2 (1.32)	1.40 (1.28)
7.	IPM minus *Trichogramma chilonis*	0 (0.71)	1 (1.22)	1 (1.10)	1 (1.17)	1 (1.22)	0.80 (1.08)
8.	IPM minus Intercropping	0 (0.71)	2 (1.58)	2 (1.32)	2 (1.47)	2 (1.48)	1.60 (1.31)
9.	Farmers practice	0 (0.71)	3 (1.87)	3 (1.87)	3 (1.87)	4 (2.11)	2.60 (1.69)
	Mean	0.00 (0.71)	1.56 (1.40)	1.78 (1.43)	2.00 (1.49)	2.11 (1.51)	1.49 (1.31)
	CD (0.05): T=0.33 , D=0.25, TxD=0.74						

Mean of five replications
Figures within are square root transformed values.
DAT- Days after transplanting

Table 13. Effect of various treatments on the incidence of mite (sq/cm) in brinjal Mohini hybrid (Trial II, Dharmapuri district district, August 2007- Feb, 2008) Farmer's name: Thiru. Dhamodaran

S. No	Treatments	Number of mite/sq m at indicated days after transplanting					
		45 DAT	60 DAT	75 DAT	90 DAT	120 DAT	Mean
1.	IPM	0 (0.71)	3 (1.87)	4 (1.91)	4 (1.65)	5 (2.35)	3.20 (1.70)
2.	IPM minus *P. fluorescens*	1 (1.22)	2 (1.47)	3 (1.87)	3 (1.50)	3 (1.71)	2.40 (1.55)
3.	IPM minus Neem cake	1 (1.22)	3 (1.87)	3 (1.86)	4 (2.11)	4 (2.12)	3.00 (1.83)
4.	IPM minus Yellow sheet	2 (1.58)	4 (1.91)	4 (2.11)	4 (2.12)	5 (2.35)	3.80 (2.02)
5.	IPM minus NSKE 5%	2 (1.58)	5 (2.30)	5 (2.35)	5 (2.10)	5 (2.35)	4.40 (2.13)
6.	IPM minus FORS 2%	2 (1.47)	3 (1.71)	4 (1.91)	4 (2.12)	4 (1.65)	3.40 (1.77)
7.	IPM minus *Trichogramma chilonis*	2 (1.58)	2 (1.58)	2 (1.32)	3 (1.87)	3 (1.86)	2.40 (1.64)
8.	IPM minus Intercropping	2 (1.58)	3 (1.87)	3 (1.86)	3 (1.79)	3 (1.87)	2.80 (1.80)
9.	Farmers practice	5 (2.10)	5 (2.30)	6 (2.55)	6 (2.55)	6 (2.26)	5.60 (2.35)
	Mean	1.89 (1.50)	3.33 (1.88)	3.78 (1.97)	4.00 (1.95)	4.22 (2.09)	3.44 (1.87)
	CD (0.05): T=0.50 , D=0.37 TxD=1.11						

Mean of five replications
Figures within are square root transformed values.
DAT- Days after transplanting

Incidence of diseases

Brinjal

It was observed that two fungal diseases and one viral disease *viz.*, leaf spot (*Alternaria solani*), wilt (*Fusarium solani*), Mosaic were predominant in Coimbatore district whereas in Dharmapuri district only leaf spot (*A. solani*) was widely prevalent. Incidence of the disease was noticed from 30 days after planting and maximum disease incidence was recorded on 120 days after planting for diseases in all the treatments. Among the three diseases, leaf spot was found to be severe under Coimbatore condition which recorded a maximum of 55.56 PDI in the plots where farmers practice was adopted followed by mosaic and wilt.

Coimbatore

The results revealed that IPM consisting of seed treatment with *P. fluorescens*, soil application of neem cake, foliar application of fish oil rosin soap (2 per cent) thrice, neem seed kernel extract (5 per cent) thrice, keeping yellow sticky trap, releasing *Trichogramma chilonis* and intercropping with coriander was found to be superior to all the treatments as it recorded only 9.34 per cent, 13. 64 per cent and 19.77 PDI for wilt, mosaic and leaf spot respectively. The plots of farmers practice recorded a maximum incidence of 55.56, 38.70 and 32.46 for leaf spot, mosaic and wilt on 120 DAT followed by IPM plot without *P. fluorescens* (46.02 PDI) for leaf spot. On comparing the treatments effects with farmers practice mosaic incidence was found to severe in the IPM plots without NSKE (33.04 Per cent) which was on par with neem cake (31.57 Per cent) indicating that both neem cake and NSKE effectively controls aphids which acts as a vector for the transmission of the virus. In case of wilt the efficacy of *P. fluorescens* and neem cake were on par with a PDI of 26.86 and 24.21 respectively (Tables 14, 15 and 16).

Dharmapuri

The results follow the same trend as that of the trial at Coimbatore. IPM plot recorded minimum PDI of 9.75 in trial I and 15.03 in trial II for leaf spot disease. Maximum PDI was recorded in the plots where farmers practice (34.47 and 46.61 PDI) was adopted which was followed by the IPM plots without *P. fluorescens* (26.61 and 36.48 PDI) for trial I and trial II respectively (Tables 17 & 18).

Okra

It was observed that only powdery mildew was widely prevalent and the disease incidence was observed from 30 DAS and was maximum on 60 days after sowing in all the treatments. Among the treatments, IPM practices consisting of seed treatment with *Pseudomonas fluorescens*, soil application of neem cake, foliar application of fish oil rosin soap (2 per cent) thrice, neem seed

kernel extract (5 per cent) thrice and keeping yellow sticky trap were found to be very effective as it recorded only 19.17 per cent disease incidence in trial I and 15.26 per cent in trial II on 60 DAS. On comparing the other treatment effects, maximum PDI was observed in the plots where farmers practice was adopted (72.27 PDI and 64.20 PDI) followed by the IPM plot without *P. fluorescens* (54.30 per cent and 48.11 per cent) indicating that *P. fluorescens* plays an important role in controlling the disease (Tables 19 & 20).

Table 14. Effect of different treatments on the incidence of leaf spot of brinjal under field condition in Theethipalayam, Coimbatore (August, 2007 – February, 2008) (Farmer - Suseela)

S. No	Treatments	Per cent Disease Index				
		30 DAT	60 DAT	90 DAT	120 DAT	Mean
1.	IPM	1.34 (5.52)	8.103 (16.52)	13.64 (21.63)	19.77 (26.39)	10.71 (17.51)
2.	IPM minus *P. fluorescens*	24.38 (29.58)	30.84 (33.73)	36.91 (37.41)	46.02 (42.71)	34.53 (35.86)
3.	IPM minus Neem cake	22.39 (28.24)	28.58 (32.31)	33.29 (35.23)	40.78 (39.68)	31.26 (33.86)
4.	IPM minus Yellow sheet	17.72 (24.87)	25.48 (30.31)	29.37 (32.80)	37.35 (37.67)	27.48 (31.41)
5.	IPM minus NSKE 5%	20.85 (27.15)	25.94 (30.61)	33.98 (35.65)	41.22 (39.94)	30.49 (33.34)
6.	IPM minus FORS 2%	12.63 (20.81)	16.45 (23.93)	20.44 (26.86)	26.44 (30.94)	18.99 (25.64)
7.	IPM minus *Trichogramma chilonis*	13.37 (21.43)	18.47 (25.44)	23.45 (28.95)	27.69 (31.73)	20.74 (26.89)
8.	IPM minus Intercropping	15.51 (23.19)	21.40 (27.5)	26.24 (30.81)	33.04 (35.08)	24.04 (29.15)
9.	Farmers practice	31.20 (33.95)	37.74 (37.90)	41.83 (40.29)	55.56 (48.19)	41.58 (40.08)
	Mean	17.71 (23.86)	23.66 (28.70)	28.79 (32.18)	36.43 (36.93)	26.65 (30.42)
	CD:(0.05) t: 0.98 d: 0.65 td: 1.96					

Mean of five replications
Figures within are square root transformed values.
DAT- Days after transplanting

Table 15. Effect of different treatments on the incidence of mosaic of brinjal under field condition in Theethipalayam, Coimbatore (August, 2007 – February, 2008) (Farmer - Suseela)

S. No	Treatments	Per cent Disease Incidence				
		30 DAT	60 DAT	90 DAT	120 DAT	Mean
1.	IPM	0.99 (4.70)	8.46 (16.88)	10.26 (18.31)	13.64 (21.64)	8.33 (15.38)
2.	IPM minus *P. fluorescens*	9.76 (18.18)	20.46 (26.87)	27.61 (31.67)	18.48 (25.46)	19.07 (25.54)
3.	IPM minus Neem cake	7.13 (16.02)	12.42 (20.61)	18.19 (25.24)	31.57 (34.17)	16.60 (23.55)
4.	IPM minus Yellow sheet	9.29 (17.67)	15.54 (23.21)	21.03 (27.27)	22.53 (28.3)	17.0975 (24.12)
5.	IPM minus NSKE 5%	12.70 (20.84)	17.61 (24.77)	21.77 (27.80)	33.04 (35.08)	20.91 (26.89)
6.	IPM minus FORS 2%	7.48 (15.86)	13.54 (21.52)	15.39 (22.97)	24.61 (29.74)	15.255 (22.52)
7.	IPM minus *Trichogramma chilonis*	5.69 (13.61)	10.58 (18.73)	14.15 (22.09)	17.60 (24.80)	12.01 (19.81)
8.	IPM minus Intercropping	4.47 (11.76)	11.33 (19.42)	16.29 (23.80)	20.55 (26.83)	13.16 (20.45)
9.	Farmers practice	17.79 (24.93)	24.63 (29.75)	32.64 (34.82)	38.70 (38.31)	28.44 (31.98)
	Mean	8.36 (15.95)	14.95 (22.42)	19.70 (26.00)	24.04 (29.08)	16.76 (23.36)
	CD:(0.05) t :1.85 d: 1.23 td: 3.71					

Mean of five replications
Figures within are square root transformed values.
DAT- Days after transplanting

Table 16. Effect of different treatments on the incidence of wilt of brinjal under condition in Theerthipalayam, Coimbatore (August, 2007 – February, 2008) (Farmer - Suseela)

S. No	Treatments	Percent Disease Incidence				
		30 DAT	60 DAT	90 DAT	120 DAT	Mean
1.	IPM	0.00 (0.28)	0.94 (3.41)	6.01 (13.56)	9.34 (17.79)	4.07 (8.77)
2.	IPM minus *P. fluorescens*	9.47 (7.78)	17.58 (24.76)	20.85 (27.14)	26.86 (31.19)	18.69 (25.22)
3.	IPM minus Neem cake	8.49 (16.89)	15.51 (23.19)	17.25 (24.46)	24.21 (29.44)	16.3 (23.49)
4.	IPM minus Yellow sheet	1.07 (4.91)	7.233 (15.20)	11.46 (19.73)	12.51 (20.69)	8.06 (15.13)
5.	IPM minus NSKE 5%	2.27 (7.14)	12.01 (19.96)	14.83 (22.61)	20.36 (26.80)	12.36 (19.13)
6.	IPM minus FORS 2%	2.94 (9.83)	8.27 (16.63)	12.32 (20.55)	17.27 (24.55)	10.2 (17.89)
7.	IPM minus *Trichogramma chilonis*	3.83 (11.23)	7.88 (16.29)	11.40 (19.43)	14.36 (22.14)	9.36 (17.27)
8.	IPM minus Intercropping	5.32 (12.92)	10.84 (19.09)	15.54 (23.20)	19.75 (26.38)	12.86 (20.40)
9.	Farmers practice	12.97 (21.04)	20.63 (27.01)	27.7 (31.67)	32.46 (34.70)	23.44 (28.60)
	Mean	5.151 (11.34)	11.210 (18.39)	15.26 (22.48)	19.68 (25.97)	12.82 (19.55)
	CD(0.05)	t: 2.26	d: 1.50	td: 4.52		

Mean of five replications
Figures within are square root transformed values.
DAT- Days after transplanting

Table 17. Effect of different treatments on the incidence of leaf spot of brinjal under field condition in Kollupatti, Dharmapuri (August, 2007 – February, 2008). Farmer's name: Thiru. Ravi

S. No	Treatments	Per cent Disease Index				
		30 DAT	60 DAT	90 DAT	120 DAT	Mean
1.	IPM	0.00 (0.28	0.513 (2.56)	5.74 (12.95)	9.75 (18.17)	4.00 (8.49)
2.	IPM minus *P. fluorescens*	10.63 (19.02)	15.16 22.90)	25.40 (30.23)	26.61 (30.96)	19.45 (25.78)
3.	IPM minus Neem cake	8.45 (16.90)	13.43 (21.49)	17.44 (24.66)	20.77 (27.10)	15.02 (22.54)
4.	IPM minus Yellow sheet	2.93 (8.14)	9.67 (17.80)	14.57 (22.43)	18.81 (25.63)	11.49 (18.50)
5.	IPM minus NSKE 5%	6.50 (14.77)	11.24 (19.20)	13.37 (21.35)	19.65 (26.29)	12.69 (20.40)
6.	IPM minus FORS 2%	5.26 (13.08)	10.41 (18.69)	13.36 (21.43)	15.48 (23.15)	11.12 (19.09)
7.	IPM minus *Trichogramma chilonis*	1.35 (5.50)	8.06 (16.48)	14.43 (22.16)	18.95 (25.75)	10.69 (17.47)
8.	IPM minus Intercropping	7.37 (15.67)	10.93 (19.06)	16.41 (23.89)	21.56 (27.54)	14.06 21.54)
9.	Farmers practice	13.31 (21.35)	20.19 (26.69)	25.78 (30.43)	34.47 (35.93)	23.43 (28.60)
	Mean	6.2 (12.75)	11.06 (18.32)	16.27 (23.28)	20.67 (26.72)	13.55 (20.27)
	CD:(0.05) t :2.26 d: 1.51 td: 4.53					

Mean of five replications
Figures within are square root transformed values.
DAT- Days after transplanting

Table 18. Effect of different treatments on the incidence of leaf spot of brinjal under condition in Kollupatti, Dharmapuri (August, 2007 –February, 2008). Farmer's name: Thiru. Dhamodaran

S. No	Treatments	Per cent Disease Index				
		30 DAT	60 DAT	90 DAT	120 DAT	Mean
1.	IPM	0.00 (0.28)	4.21 (11.67)	8.66 (16.16)	15.03 (22.81)	6.975 (12.73)
2.	IPM minus *P. fluorescens*	14.41 (22.30)	19.42 (26.15)	26.69 (31.09)	36.48 (37.15)	24.25 (29.17)
3.	IPM minus Neem cake	10.35 (18.65)	14.30 (22.18)	19.77 (26.39)	27.28 (31.48)	17.92 (24.68)
4.	IPM minus Yellow sheet	5.66 (13.61)	9.38 (17.45)	15.31 (22.93)	23.32 (28.85)	13.41 (20.71
5.	IPM minus NSKE 5%	9.32 (17.75)	15.68 (23.19)	20.38 (26.82)	30.36 (33.37)	18.93 (25.28)
6.	IPM minus FORS 2%	3.7176 (11.05)	9.20 (17.49)	13.29 (21.34)	24.76 (29.79)	12.744 (19.92)
7.	IPM minus *Trichogramma chilonis*	5.40 (13.43)	8.77 (17.05)	14.54 (22.38)	21.13 (27.36)	12.46 (20.05)
8.	IPM minus Intercropping	7. 47 (15.79)	11.73 (20.02)	15.60 (23.26)	25.65 (30.42)	15.11 (22.38)
9.	Farmers practice	18.55 (25.49)	25.67 (30.35)	36.76 (37.27)	46.61 (43.05)	31.89 (34.04)
	Mean	8.319 (15.37)	13.15 (20.62)	19.00 (25.29)	27.85 (31.59)	17.08 (23.22)
	CD: (0.05)	t: 1.91	d: 1.27	td: 3.83		

Mean of five replications
Figures within are square root transformed values.
DAT- Days after transplanting

Table 19. Effect of different treatments on the incidence of Powdery mildew of Bhendi under field condition in Kollupatti, Dharmapuri (September – December, 2007) Farmer's name: Thiru. Ravi

S. No	Treatments	Per cent Disease Index				
		30 DAS	40 DAS	50 DAS	60 DAS	Mean
1.	IPM	1.36 (5.54)	7.77 (16.08)	13.10 (21.15)	19.17 (25.83)	10.35 (17.15)
2.	IPM minus *P. fluorescens*	28.78 (32.41	35.46 (36.54)	44.59 (41.88)	54.30 (47.47)	40.78 (39.58)
3.	IPM minus Neem cake	19.83 (26.38	24.46 (29.58)	30.59 (33.58)	35.42 (36.52)	27.57 (31.52)
4.	IPM minus Yellow sheet	13.49 (21.54)	17.30 (24.57)	21.53 (27.64)	26.51 (30.98)	19.71 (26.19)
5.	IPM minus NSKE 5%	25.04 (29.96)	31.13 (33.90)	34.99 (36.26)	43.22 (41.09)	33.50 (35.31)
6.	IPM minus FORS 2%	12.54 (20.66)	18.30 (25.31)	24.10 (29.39)	25.16 (30.09)	20.03 (26.37)
7.	Farmers practice	32.56 (34.74)	46.58 (43.03)	60.4 (51.02)	72.27 (58.24)	52.95 (46.76)
	Mean	19.08 (24.46)	25.86 (29.86)	32.76 (34.42)	39.44 (38.60)	29.28 (31.84)
	CD: (0.05) t: 1.78 d: 1.35 td: 3.57					

Mean of five replications
Figures within are square root transformed values.
DAS- Days after sowing

Table 20. Effect of different treatments on the incidence of Powdery mildew of Bhendi under field condition in Kollupatti, Dharmapuri (September – December, 2007)
Farmer's name: Thiru. Dhamodaran

S. No	Treatments	Per cent Disease Index				
		30 DAS	40 DAS	50 DAS	60 DAS	Mean
1.	IPM	2.51 (7.49)	6.08 (14.25)	12.57 (20.62)	15.26 (22.81)	9.10 (16.29)
2.	IPM minus *P. fluorescens*	24.14 (29.39)	27.01 (31.29)	34.32 (35.84)	48.11 (43.91)	33.39 (35.11)
3.	IPM minus Neem cake	20.77 (27.08)	23.74 (29.12)	31.07 (33.87)	37.4 (37.69)	28.24 (31.94)
4.	IPM minus Yellow sheet	14.14 (21.97)	18.53 (25.49)	21.89 (27.84)	29.10 (32.64)	20.91 (26.99)
5.	IPM minus NSKE 5%	24.16 (29.44)	26.45 (30.93)	30.76 (33.66)	35.35 (36.45)	29.18 (32.62)
6.	IPM minus FORS 2%	11.51 (19.71)	20.53 (26.94)	25.67 (30.38)	31.79 (34.31)	22.37 (27.84)
7.	Farmers practice	30.90 (33.76)	37.96 (37.98)	54.84 (47.78)	64.20 (53.26)	46.97 (43.19)
	Mean	18.30 (24.13)	22.90 (28.01)	30.16 (32.86)	37.31 (37.30)	27.17 (30.57)
	CD: (0.05)	t :1.84		d: 1.39	td: 3.69	

Mean of five replications
Figures within are square root transformed values.
DAS- Days after sowing

Incidence of nematodes

Brinjal

The results revealed that root-knot nematode infestation was predominant, while population of *Helicotylenchus* and *Hoplolaimus* was negligible. Among the treatments IPM which included seed treatment with *P. fluorescens*, soil application of neem cake, foliar application of fish oil rosin soap (2 per cent) thrice, neem seed kernel extract (5 per cent) thrice, keeping yellow sticky trap, releasing *Trichogramma chilonis* and intercropping with coriander significantly reduced the soil population of root-knot nematode both in Dharmapuri and Coimbatore field experiments, where as in the farmers practice and the treatment IPM minus neem cake recorded high nematode population (Tables 21-23). The toxic principles in neem cake due to their nematicidal property might have attributed for the reduction in nematode population. The gall index was the lowest in the IPM and highest index of 5 was recorded (Table 26) in farmer's practice.

Okra

In both the Dharmapuri trials, there was a decline in nematode population in the IPM plots which consist of seed treatment with *Pseudomonas fluorescens*, soil application of neem cake, foliar application of fish oil rosin soap (2 per cent) thrice, neem seed kernel extract (5 per cent) thrice and keeping yellow sticky trap. The IPM void of neem cake treatment resulted in high nematode population and the highest was in the farmer's practice (Table 24 & 25). Similarly the gall index was the lowest in IPM (2.3) as against the farmer's practice (5.0) which recorded the highest in a 1-5 scale (Table 27).

Table 21. Soil population of root-knot nematode *M. incognita* (No./250 cc soil) in Brinjal at Kollupatti, Dharmapuri (Aug2007- Feb 2008) (Farmer Thiru. Dhamodaran)

Treatments	30 DAT	60 DAT	90 DAT	120 DAT	Mean
IPM	209.0 (14.45)	217.3 (14.74)	236.0 (15.36)	256.0 (15.60)	229.5 (15.14)
IPM minus *P. fluorescens*	290.0 (17.03)	292.3 (17.10)	303.0 (17.40)	307.0 (17.52)	298.07 (17.26)
IPM minus NSKE	298.0 (17.26)	309.6 (17.60)	306.0 (17.50)	311.0 (17.63)	306.22 (17.50)
IPM minus Yellow sticky trap	312.3 (17.74)	313.6 (17.71)	229.0 (17.95)	323.6 (17.99)	294.62 (17.85)
IPM minus Neem cake	346.0 (18.60)	359.6 (18.96)	373.3 (19.32)	379.6 (19.48)	364.62 (19.09)
IPM minus FORS	292.3 (17.10)	294..0 (17.15)	304.0 (17.43)	303.3 (17.41)	298.40 (17.27)
IPM minus *Trichogramma chiloris*	305.0 (17.46)	292.6 (17.11)	306.6 (17.51)	311.6 (17.65)	303.95 (17.43)
IPM minus Intercropping	302.0 (17.37)	309.3 (17.57)	313.6 (17.79)	320.3 (17.90)	312.05 (17.66)
Farmer's practice	319.6 (17.88)	343.3 (18.52)	380.0 (19.48)	391.6 (19.78)	358.62 (18.91)
Mean	297.13 (17.21)	303.51 (17.39)	306.08 (17.75)	322.66 (17.93)	307.35 (17.57)

Table 22. Soil population of root-knot nematode *M. incognita* (No./250 cc soil) in Brinjal under field conditions at Kollupatti, Dharmapuri (Aug 2007-Feb 2008) (Farmer: Thiru. Ravi)

Treatments	30 DAT	60 DAT	90 DAT	120 DAT	Mean
IPM	220.0 (14.82)	228.6 (15.11)	238.6 (15.44)	257.0 (16.03)	236.05 (15.36)
IPM minus *P. fluorescens*	276.6 (16.63)	280.0 (16.73)	297.6 (17.25)	300.0 (17.31)	288.55 (16.98)
IPM minus NSKE	290.0 (17.02)	290.3 (17.03)	293.0 (17.09)	301.6 (17.36)	293.72 (17.13)
IPM minus Yellow sticky trap	287.0 (16.94)	294.3 (17.15)	299.6 (17.30)	304.0 (17.43)	296.22 (17.21)
IPM minus Neem cake	289.0 (16.99)	311.3 (17.64)	317.3 (17.81)	324.3 (18.00)	310.47 (17.62)
IPM minus FORS	287.6 (16.96)	305.3 (17.34)	292.6 (17.10)	299.0 (17.29)	296.12 (17.18)
IPM minus *Trichogramma chiloris*	284.0 (16.85)	301.0 (17.34)	303.6 (17.42)	310.0 (17.61)	299.65 (17.31)
IPM minus Intercropping	251.6 (17.16)	282.3 (16.80)	293.6 (17.13)	301.6 (17.36)	282.27 (17.12)
Farmer's practice	296.0 (17.20)	335.0 (18.30)	347.6 (18.62)	371.6 (19.27)	337.40 (18.35)
Mean	275.75 (16.73)	292.01 (17.05)	298.10 (17.25)	307.67 (17.52)	293.38 (17.14)

Figures in parentheses are √n transformed values; CD (0.05): T- 0.18; D- 0.12; T x D- 0.37;
DAT- Days after transplanting

Table 23. Soil population of root-knot nematode *M. incognita* (No./250 cc soil) in Brinjal at Theethipalayam, Coimbatore (Sep 2007- Feb 2008) (Farmer - Suseela)

Treatments	30 DAT	60 DAT	90 DAT	120 DAT	Mean
IPM	260.0 (16.12)	266.3 (16.31)	268.3 (16.38)	274.0 (16.55)	267.15 (16.34)
IPM minus *P. fluorescens*	285.6 (16.90)	282.3 (16.80)	292.6 (17.11)	294.3 (17.16)	288.70 (17.0)
IPM minus NSKE	289.0 (17.00)	286.3 (16.92)	298.0 (17.26)	298.3 (17.27)	292.90 (17.11)
IPM minus Yellow sticky trap	294.0 (17.14)	294.6 (17.16)	306.0 (17.49)	308.6 (17.57)	300.80 (17.34)
IPM minus Neem cake	303.3 (17.41)	320.6 (17.91)	338.3 (18.39)	345.0 (18.57)	326.80 (18.07)
IPM minus FORS	292.0 (17.09)	292.0 (17.08)	284.3 (16.86)	296.3 (17.21)	291.15 (17.06)
IPM minus *Trichogramma chiloris*	286.3 (16.91)	295.3 (17.19)	304.6 (17.45)	303.6 (17.42)	297.45 (17.25)
IPM minus Intercropping	290.0 (17.03)	299.6 (17.31)	301.6 (17.37)	302.0 (17.38)	298.30 (17.27)
Farmer's practice	297.3 (17.24)	329.6 (18.15)	345.0 (18.57)	331.0 (18.19)	325.75 (18.04)
Mean	288.61 (16.98)	296.28 (17.21)	304.30 (17.43)	305.90 (17.48)	298.77 (17.27)

Figures in parentheses are √n transformed values; CD (0.05): T- 0.18; D- 0.12; T x D- 0.37;
DAT- Days after transplanting

Table 24. Soil population of root-knot nematode *M. incognita* (No./250 cc soil) in Bhendi at Dharmapuri (Farmer : Thiru. Dhamodaran)

Treatments	10 DAS	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	Mean
IPM	56.0 (7.46)	72.6 (8.51)	84.3 (9.17)	90.6 (9.52)	103.6 (10.18)	123.3 (11.10)	88.50 (9.33)
IPM minus *P.fluorescens*	89.0 (9.42)	96.6 (9.82)	113.0 (10.55)	119.0 (10.91)	122.6 (11.07)	217.0 (14.73)	126.20 (11.09)
IPM minus Neem cake	102.3 (10.11)	112.3 (10.59)	125.3 (11.16)	150.3 (12.26)	188.3 (13.72)	300.0 (17.32)	163.08 (12.53)
IPM minus Yellow sticky trap	78.3 (8.84)	92.0 (9.58)	95.6 (9.77)	111.6 (10.57)	139.0 (11.78)	275.3 (16.54)	131.96 (11.18)
IPM minus NSKE	82.0 (9.05)	95.0 (9.74)	105.6 (10.26)	123.6 (11.12)	182.3 (13.50)	223.0 (14.93)	135.25 (11.43)
IPM minus FORS	88.6 (9.40)	87.3 (9.34)	104.3 (10.21)	184.0 (13.56)	195.0 (13.96)	236.0 (15.37)	149.20 (11.97)
Farmer's practice	130.3 (12.05)	133.6 (11.55)	151.3 (10.29)	245.6 (15.67)	253.0 (15.91)	330.3 (18.13)	207.35 (14.27)
Mean	89.50 (9.48)	98.40 (9.88)	111.34 (10.49)	146.38 (11.94)	169.11 (12.88)	243.55 (15.45)	143.04 (11.69)

Figures in parentheses are √n transformed values; CD (0.05): T- 0.18; D- 0.12; T x D- 0.37;
DAS - Days after sowing

Table 25. Soil population of root-knot nematode *M. incognita* (No./250 cc soil) under field condition in Bhendi in Kollupatti, Dharmapuri (Sep- Dec, 2007) (Farmer: Thiru. Ravi)

Treatments	10 DAS	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	Mean
IPM	76.6 (8.75)	88.6 (9.41)	91.3 (9.55)	105.3 (10.26)	116.6 (10.78)	159.0 (12.59)	106.23 (10.22)
IPM minus *P.fluorescens*	91.3 (9.54)	101.0 (10.04)	117.3 (10.83)	125.3 (11.19)	132.0 (11.48)	218.6 (14.78)	130.91 (11.31)
IPM minus Neem cake	105.6 (10.27)	119.3 (10.92)	147.0 (12.12)	163.0 (12.76)	199.6 (14.12)	309.6 (14.12)	174.01 (12.97)
IPM minus Yellow sticky trap	82.3 (9.07)	97.3 (9.86)	97.3 (9.86)	108.6 (10.42)	159.0 (12.60)	208.6 (12.60)	125.51 (11.05)
IPM minus NSKE	83.0 (9.56)	99.3 (10.42)	106.0 (11.17)	129.0 (11.70)	194.3 (14.27)	233.3 (14.27)	104.76 (12.15)
IPM minus FORS	93.6 (9.67)	89.0 (9.43)	112.0 (10.42)	180.6 (13.43)	199.6 (14.12)	261.0 (14.12)	155.96 (12.21)
Farmer's practice	141.3 (11.91)	139.6 (11.81)	160.3 (12.65)	250.3 (15.82)	265.6 (16.29)	313.0 (16.29)	211.68 (14.36)
Mean	96.24 (9.83)	104.87 (10.27)	118.74 (10.94)	151.72 (12.23)	180.95 (13.39)	243.30 (15.57)	149.30 (12.04)

Figures in parentheses are √n transformed values; CD (0.05): T- 0.18; D- 0.12; T x D- 0.37;
DAS - Days after sowing

Table 26. Gall index (Scale 1-5) of root-knot nematode *M. incognita* in brinjal field experiment in Dharmapuri and Coimbatore (Aug 2007-Feb 2008)

Treatments	Trial 1- Dharmapuri (Thiru. Ravi)	Trial 2 - Dharmapuri (Thiru. Dhamodaran)	Trial 3 - Coimbatore (Theethipalayam)	Mean
IPM	2.3 (1.52)	2.6 (1.62)	2.3 (1.52)	2.40 (1.55)
IPM minus *P. fluorescens*	3.6 (1.91)	3.3 (1.82)	3.6 (1.82)	3.50 (1.88)
IPM minus NSKE	3.3 (1.82)	3.6 (1.91)	3.3 (1.91)	3.40 (1.85)
IPM minus Yellow sticky trap	3.6 (1.91)	3.6 (1.91)	4.0 (1.91)	3.73 (1.93)
IPM minus Neem cake	4.6 (2.15)	4.6 (2.15)	4.6 (2.15)	4.60 (2.15)
IPM minus FORS	4.0 (1.98)	4.3 (2.07)	4.0 (2.07)	4.10 (2.02)
IPM minus *T. chiloris*	4.0 (2.00)	3.6 (1.91)	3.6 (1.91)	3.73 (1.94)
IPM minus Intercropping	3.6 (1.91)	4.0 (1.98)	3.6 (1.98)	3.73 (1.93)
Farmer's practice	5.0 (2.23)	5.0 (2.23)	5.0 (2.23)	5.00 (2.23)
Mean	3.77 (1.93)	3.84 (1.96)	3.77 (1.93)	3.80 (1.94)

Figures in parentheses are √n transformed values; CD (0.05): T-0.14; D-0.08; T x D-0.25

Table 27. Gall index (Scale 1-5) of root-knot nematode *M. incognita* in bhendi field experiment Dharmapuri (Sep-Dec 2007)

Treatments	Trial 1- Dharmapuri (Thiru. Ravi)	Trial 2 - Dharmapuri (Thiru. Dhamodaran)	Mean
IPM	2.3 (1.52)	2.6 (1.62)	2.45 (1.57)
IPM minus *P. fluorescens*	3.6 (1.91)	3.3 (1.82)	3.45 (1.86)
IPM minus Neem cake	4.6 (2.15)	4.0 (2.0)	4.30 (2.07)
IPM minus Yellow sticky trap	3.3 (1.82)	3.6 (1.91)	3.45 (1.86)
IPM minus NSKE	3.6 (1.91)	4.3 (2.07)	3.95 (1.99)
IPM minus FORS	4.0 (2.0)	4.0 (2.0)	4.0 (2.0)
Farmer's practice	5.0 (2.23)	5.0 (2.23)	5.0 (2.23)
Mean	3.77 (1.93)	3.82 (1.95)	3.8 (1.94)

Figures in parentheses are √n transformed values
CD (0.05): T-0.15; D-0.08; T x D-0.21

Table 28. Effect of different treatments on yield (tonnes/ha) of bhendi in different hybrids

Treatments	Yield (tonnes/ha)		
	Trial 1 (US7109) (Thiru. Ravi)	Trial 2 (US7109) (Thiru. Dhamodaran)	Mean
IPM	15.88 (4.04)	13.10 (3.68)	14.49 (3.86)
IPM minus *P. fluorescens*	7.12 (2.74)	6.39 (2.58)	6.76 (2.66)
IPM minus NSKE5%	9.75 (3.20)	7.75 (2.58)	8.75 (3.03)
IPM minus Yellow sticky trap	7.32 (2.80)	6.23 (2.57)	6.78 (2.69)
IPM minus Neem cake	9.30 (3.13)	7.31 (2.78)	8.30 (2.95)
IPM minus FORS	7.36 (2.79)	6.95 (2.69)	7.20 (2.74)
Farmer's practice	6.72 (2.69)	5.84 (2.50)	6.28 (2.59)
Mean	9.06 (3.06)	7.65 (2.81)	8.34 (2.93)

CD (0.05): Treatment: 0.24, Trial: 0.13, Treatment xTrial: 0.34

Table 29. Effect of different treatments on yield of brinjal in different hybrids (t/ha)

Treatments	Fruit yield (tonnes/ha)			
	Trial 1- Dharmapuri (Thiru. Ravi)	Trial 2 - Dharmapuri (Thiru.Dhamodaran)	Trial 3 - Coimbatore (Theethipalayam)	Mean
IPM	75.75 (7.26)	71.22 (8.46)	33.45 (7.51)	60.14 (7.74)
IPM minus *P. fluorescens*	57.63 (7.74)	52.22 (7.88)	25.00 (7.93)	44.95 (7.85)
IPM minus NSKE5%	60.21 (7.63)	56.00 (7.31)	27.63 (6.71)	47.94 (7.22)
IPM minus Yellow sticky trap	64.75 (7.62)	61.65 (8.73)	29.72 (7.79)	52.04 (8.04)
IPM minus Neem cake	69.45 (8.36)	59.42 (8.07)	31.00 (7.98)	53.29 (8.14)
IPM minus FORS	63.24 (7.84)	62.55 (7.58)	29.00 (7.16)	51.59 (7.52)
IPM minus *T. chiloris*	57.00 (5.04)	53.04 (5.82)	24.56 (5.30)	44.86 (5.39)
IPM minus Intercropping	61.02 (5.61)	57.85 (5.49)	28.12 (5.42)	48.99 (5.51)
Farmer's practice	50.78 (5.34)	44.63 (5.00)	23.58 (4.90)	39.66 (5.08)
Mean	62.20 (6.94)	57.62 (7.15)	28.00 (6.74)	49.27 (6.94)

CD (0.05): Treatment: 0.13, Trial: 0.08, Treatment x Trial: 0.23

Yield

The yield of brinjal was maximum observed in hybrid Mohini than variety CO 2. Considering the yield at different trials, trial 1 at Dharmapuri had maximum yield compared to the yield in other trials. Considering the treatment effects, the IPM plot (75.75 t/ha) was found to have maximum yield than farmers plot (62.20t/ha).

Training eggplant and Okra farmers in adopting IPM

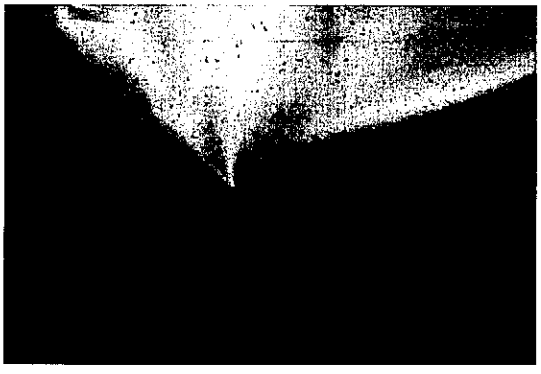
Dr. E.A. Heinrichs, IPM CRSP consultant, Virginia Tech and Dr. Greg Luther from AVRDC, Taiwan visited the brinjal and okra field trial conducted at Theerthipalayam village of Coimbatore district and Kolluppatti village of Dharmapuri district. Meeting was conducted with IPM experts from different fields like Agricultural Enomology, Plant Pathology and Nematology of TNAU to train the farmers on vegetable IPM practices. About 60 farmers in and around the Kolluppatti village, Dharmapuri district attended the meeting. Blow up charts and exhibits were prepared in regional languages and exhibited.

IPM Experts meeting the farmers

Dr. Short Heinrichs discussing with the farm family Ms.Radha and Mr.Ravi at Kollupatti, Dharmapuri

Neighbour Farmers to Mr.Ravi – project participant farmers taking a while observation of newly established brinjal at Kollupatti

Field inspection of IPM tool by farmers gathering during the visit of Dr.E.A. Heinrichs and Dr.Greg Luther to Dharmapuri, India



Aphids attracted to Yellow sheets implanted in IPM plots at Kollupatti, Dharmapuri, India

Dr.E.A.Heinrichs discusses with a young farmers on his farm plans and IPM practices on vegetable crops

Dr.M.Murugan, Dr.E.I.Jonathan and other experts with the visiting team in discussion with farmers on IPM practices in vegetable ecosystem

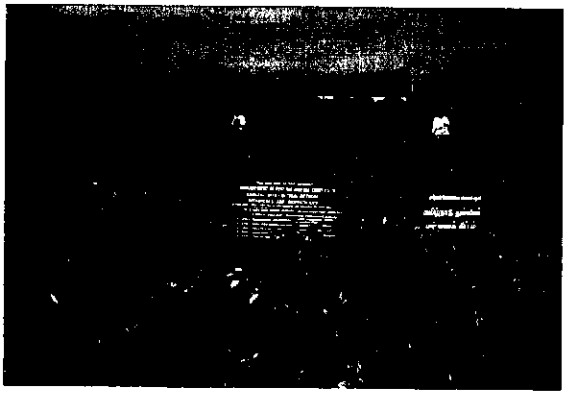
Drs.P.Karuppuchamy and M.Murugan showing the EFSB damages and sharing the views

Dr.V.Prakasam, Dr.E.I.Jonathan and Dr.Renuka meticulously planning the trial on brinjal at Dharmapuri, India

The moths are being trapped with pheromone traps to bring the farmers out of debt trap, Dharmapuri, India

What makes them to listen! – only the success and expert vision through IPM CRSP collaboration

Gathering Scientific information with the company of the women farmer at Kollupatti, Dharmapuri, India by Dr.Renuka

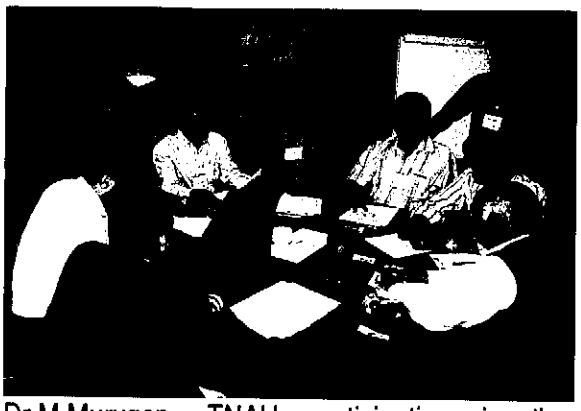


A robust brinjal crop under IPM CRSP, Virginia Tech, USA and TNAU, Coimbatore ready to uplift the farm family, Dharmapuri, India

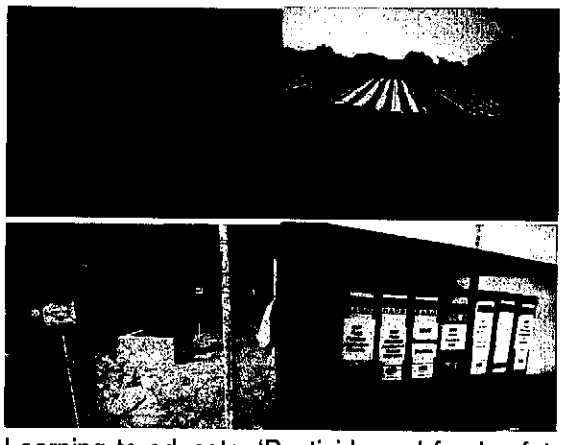
Joyous momentum to Ms.Radha – a women farmer – sharing the success with IPM experts

Dr.P.Yasoda – making scientific information on brinjal plot to differentiate the treatment effects

Ms.Suseela, farmer, Theetipalayam, Coimbatore reacts to Dr.E.A.Heinrichs, IPM Expert; IPM team in discussion with Dr.Gregory Luther, AVRDC on field trials in background



Dr.M.Murugan, TNAU participating in the 'Pesticide and food safety management workshop', Amman, Jordan, October 21 - 24, 2007. Thanks to IPM CRSP, Virginia Tech,USA.



Learning to educate: 'Pesticide and food safety management workshop', Amman, Jordan, October 21 - 24, 2007. Visit to Jordan Valley Farm to identify "PERSUAP"

Explore PERSUAP to gain better crop management practices and attract globe for quality food chain management strategy

III. Documentation of insecticide resistance in *Bemisia tabaci* and *Leucinodes orbonalis*

Monitoring of insecticide resistance in whiteflies at Tamil Nadu

Collection of whiteflies

The test insect *Bemisia tabaci* was collected from Coimbatore district at different time intervals and also from different regions of Tamil Nadu for (Table ..) making a survey on the level of resistance by applying discriminating dose.

Table 30. Sampling locations for monitoring insecticide resistance in *Bemisia tabaci* of brinjal in Tamil Nadu.

S. No	Location	Crop on which collected	Insecticide use pattern
1.	Tamil Nadu Agricultural University, Coimbatore	Brinjal	Dimethoate, Methyl demeton, Dimethoate
2.	Thayanur, Trichy Dt	Bhendi, Brinjal	Dimethoate, Methyl demeton, Dimethoate
3.	Kudumianmalai, Pudukkottai Dt	Bhendi, brinjal	Pyrethroid, Dimethoate, Methyl demeton,
4.	Kolluppatti, Dharmapuri Dt	Brinjal	Pyrethroid, Dimethoate, Methyl demeton,
5.	Pandiyan nagar, Madurai	Brinjal	Dimethoate, Methyl demeton, Dimethoate
6.	Erode		Methyl demeton Dimethoate

In the distant places monitoring was done once in a season, where as in Coimbatore it was done at fortnightly intervals.

Insecticide Dilutions

The required dilution was prepared from the formulated products of the insecticides using distilled water. The details of the insecticide formulations used are furnished in Table as given below.

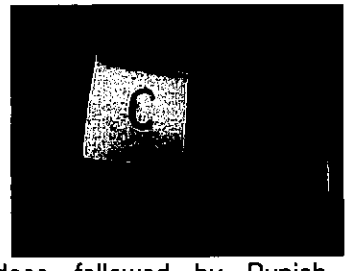
Table 31. Insecticides used for bioassay

Insecticide	IUPAC Name	Concentration	Source
Neonicotinoids			
Thiamethoxam	N-(2-chloro-thiazol-5yl-methyl)-N"-nitro-quanidine	25 per cent WG	Syngenta India Ltd., Mumbai
Imidacloprid	1(6-nicotinyl) 2 nitro iminoimidaz-obidine	17.8 per cent SL	Bayer India Ltd., Mumbai.
Organophosphates			
Monocrotophos (Nuvacron 36 WSC)	Dimethyl phosphate of 3 hydroxy-N-methyl-cis-crotonomide	36 per cent WSC	Syngenta India Ltd., Mumbai
Dimethoate (Rogor 30 EC)	O,O-dimethyl phosphate-S-(N-methyl carbamoyl methyl) phosphoro thiolothionate	30 per cent EC	Rallis India Ltd., Bangalore
Methyl demeton (Metasystox 25 EC)	O,O-dimethyl-S-(2-ethyl sulfinyl)ethyl thiophosphate	25 per cent EC	Bayer India Ltd., Mumbai.
Acephate (Acetaf 75 SP)	O,S-dimethyl acetyl phosphoramido thioate	75 per cent SP	Rallis India Ltd., Bangalore
Triazophos (Hostathion 40 EC)	O,O-diethyl O-1-phenyl-1 H-1,2,4-triazol-3-yl phosphorothioate	40 per cent EC	Hoechst India Ltd., Mumbai
Pyrethroids			
Cypermethrin (Cymbush 25 EC)	2 cyano-3 phenoxy benzyl-cis, trans-3-(2-2-dichlorovinyl)2-2 dimethyl cyclopropane carboxylate	35 per cent EC	Rallis India Ltd., Bangalore
Cyclodienes			
Endosulfan (Thiodan 35 EC)	6,7,8,9,10,10-hexa chloro-1,5,5a,6,9,9a, hexa hydro-6,9-methano-2,4,3-benzodioxathiepine 3-oxide (1)	35 per cent EC	Hoechst India Ltd., Mumbai.
Control: Acephate - DD 100 ppm			

Bioassay

Adult leaf tip bioassay followed by Elbent and Nauen (1996) was used. Leaf disc (45 mm dia) were cut from medium sized brinjal (CO 2) leaves using a cork borer and dipped in discriminating doses for five seconds, then dried on a filter paper in open air for 20 minutes. The bases of small, ventilated ploythene petridishes (50 mm dia) were filled with agar gel (12g/litre, 5 ml). The leaf dics were placed on the agar with their adaxial surface downwards. Adult whiteflies collected from the field using aspirator were anesthetized by keeping in refrigerator (4°C) for about ten minutes. The anesthetized insects were placed on a black cloth. Using a fine camel hair brush, 20 adults (mixed

sex) were then transferred on to the treated leaf discs and the system was covered with a ventilated lid. Directly after they had recovered from narcosis, the petridishes were placed upside down to stimulate the normal feeding orientation of whiteflies. The adults nor recovered were assessed. Leaf discs immersed in water alone served as control. The test was replicated thrice. Whitefly mortality was scored after 48 hours exposure to the insecticides.


Discriminating dose followed by Punjab Agricultural University, Ludhiana (Regupathy *et al.*, 1998) were used for monitoring.

Insecticides	**DD (ppm)**
1. Thiamethoxam	10
2. Imidacloprid	10
3. Acephate	100
4. Monocrotophos	100
5. Triazophos	10
6. Cypermethrin	50
7. Endosulfan	5

Statistical analysis

For each discriminating dose screen, the total number of insect's dosed and total mortality was computed. The percentage survival was calculated.

Percentage survival = [1-(number dead/number tested)] x 100

Also pooled binomial standard error was calculated:

$$= \frac{\sqrt{p(100-p)}}{n-1}$$

Where, p = percentage of larvae surviving at discriminating dose

n = total number of larvae tested at that week (Regupathy and Dhamu, 2001)

Insecticide resistance in *B. tabaci* populations from Coimbatore population of Tamil Nadu

Thiamethoxam:

The survival of *B. tabaci* to Thiamethoxam varied from 10 to 16 per cent. The maximum survival was observed during first week of February, 2008 and the minimum survival was recorded during last week of November, 2007.

Imidacloprid

The resistance frequency varied between 10 to 20 per cent. Maximum level was observed during last week of November, 2007 and the minimum level was observed during last week of second week of February, 2008.

Monocrotophos

The per cent survival to Monocrotophos varied from 30 to 36 per cent. The low level was seen during first week of November, 2007 and the higher level was seen during last week of January, 2008 and first week of February, 2008.

Acephate

The resistance frequency ranged from 16 to 28 per cent. The high level was observed during first week of December and minimum level was observed during last week of January, 2008 and first week of February, 2008.

Triazophos

The resistance frequency to Triazophos ranged from 30 to 40 per cent. During the first week of December, the low level of per cent survival was observed and high level was noticed during second week of January, 2008.

Cypermethrin

The resistance frequency of Coimbatore population to cypermethrin varied from 30 to 36 per cent. The highest level of per cent survival was noticed during first week of February and the lowest level during first week of November

Endosulfan

The resistance frequency of *B. tabaci* to endosulfan ranged from 14 to 22 per cent. The high level was observed during first week of November, 2007 and February, 2008 and the low level was noticed during last week of November and first week of December, 2007.

Survey of insecticide resistance in *B. tabaci* population from different locations of Tamil Nadu

Thiomathoxam

The resistance frequency was high (40.00 %) in the population collected from Dharmapuri and lowest was observed in Madurai population (13.33%).

Imidacloprid

The resistance frequency to Imidacloprid was high (36.67) in the populations of Dharmapuri and Trichy and the lowest (3.33%) was observed in Madurai population.

Monocrotophos

The resistance frequency to Monocrotophos varied from 10.00 to 26.67 per cent. Similarly Dharmapuri population recorded the highest (26.67%) survival followed by Pudukkottai and Madurai (16.66%). Erode population recorded the lowest per cent survival.

Acephate

Resistance frequency was higher (23.33%) in Dharmapuri population while the minimum frequency was seen in Madurai population (16.67%).

Triazophos

The survival of *B. tabaci* to Triazophos varied between 16.67 to 23.33 per cent. The maximum resistance frequency was seen in Dharmapuri and Pudukkottai (23.33%) and the minimum frequency was recorded in Erode.

Cypermethrin

Resistance level in all the populations was either equal to 20 per cent or exceeded 20 per cent.

Endosulfan

The maximum resistance frequency was observed in Dharmapuri (23.33%) and minimum frequency was observed in Erode (13.33%).

The order of insecticide resistance in *B. tabaci* in various locations is being as follows.

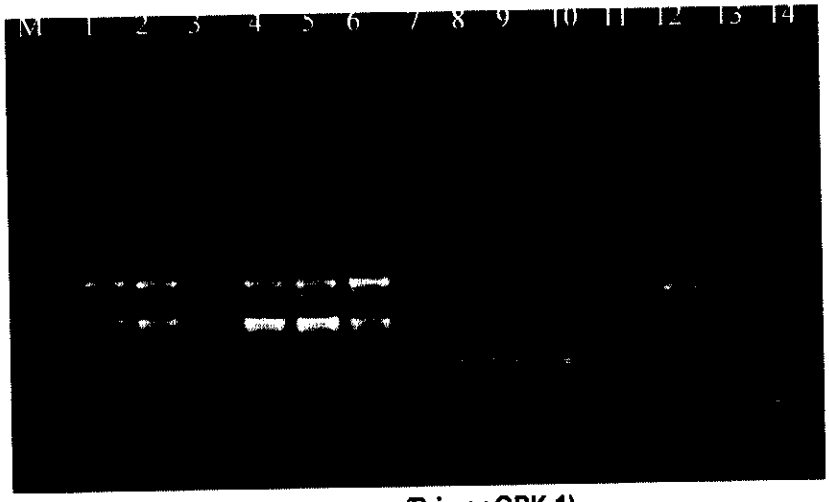
Thiamethoxam	:	Dharmapuri>Trichy>Pudukkottai=Erode>Madurai
Imidacloprid	:	Dharmapuri= Trichy> Erode>Pudukkottai>Madurai
Monocrotophos	:	Dharmapuri >Trichy>Pudukkottai=Madurai> Erode
Acephate	:	Dharmapuri> Erode>Pudukkottai>Trichy= Madurai

Triazophos : Erode>Dharmapuri=Madurai>Trichy=Pudukkottai

Cypermethrin : Dharmapuri> Madurai> Trichy= Pudukkottai= Erode

Endosulfan : Madurai>Erode=Trichy>Pudukkottai=Dharmapuri

IV. Molecular characterization of *Leucinodes orbonalis* and *Bemisia tabaci* using RAPD Primers



(Primer OPK 1)

Lane 1 - 6: *Leucinodes orbonalis*

1 - Coimbatore, 2 - Trichy, Lane 3 - Erode (not amplified), 4 - Madurai, 5 - Dharmapuri, 6 - Pudukkottai

Lane 8 - 14: *Bemisia tabaci*

Brinjal host: 7 - Coimbatore 8 - Trichy, 9 - Madurai, 10 - Dharmapuri, 11- Pudukkottai,

Bhendi host: 12 - Namakkal 13 - Krishnagiri, 14 - Tirunelveli

Random primer (OPK 1) were used in PCR amplification of *Leucinodes orbonalis* and *Bemisia tabaci* collected from different districts of Tamil Nadu and the primers generated scorable PCR products by amplifying the template DNA with *Taq* polymerase. The amplified products were separated on 1.5 per cent agarose gel and stained with ethidium bromide. The products generated were viewed, documented and presence and absence of bands were scored. Based on the initial studies, *L. orbonalis* collected from different regions were found to be similar. The whiteflies collected from brinjal (Coimbatore, Trichy, Madurai, Dharmapuri and Pudukkottai) and bhendi (Namakkal, Krishnagiri and Tirunelveli) were found to be dissimilar. To study the extent of dissimilarity, analysis with more primers is in progress.

Table 32. Monitoring insecticide resistance in Coimbatore population of *Bemisia tabaci*

Date	Thiamethoxam		Imidacloprid		Monocrotophos		Acephate		Triazophos		Cypermethrin		Endosulfan	
	No dead /No tested	% Survival ±SE	No dead /No tested	% Survival ±SE	No dead /No tested	% Survival ±SE	No dead /No tested	% Survival ±SE	No dead /No tested	% Survival ±SE	No dead /No tested	% Survival ±SE	No dead /No tested	% Survival ±SE
05.11.2007	44/50	12.00+3.39	41/50	18.00+4.09	35/50	30.00+5.10	40/50	20.00+4.29	33/50	34.00+5.37	35/50	30.00+5.10	39/50	22.00+4.47
30.11.2007	45/50	10.00+3.11	40/50	20.00+4.29	34/50	32.00+5.49	41/50	18.00+4.09	34/50	32.00+5.49	33/50	34.00+5.37	41/50	18.00+4.09
07.12.2007	47/50	6.00+2.44	42/50	16.00+3.89	33/50	34.00+5.37	42/50	16.00+3.89	35/50	30.00+5.10	34/50	32.00+5.49	41/50	18.00+4.09
11.01.2008	45/50	10.00+9.69	45/50	10.00+3.11	33/50	34.00+5.37	38/50	24.00+4.64	30/50	40.00+5.71	34/50	32.00+5 49	43/50	14.00+3.64
25.01.2008	44/50	12.00+11.51	46/50	8.00+7.83	32/50	36.00+5.49	36/50	28.00+4.96	34/50	32.00+5.49	33/50	34.00+5.37	38/50	24.00+4.64
04.02.2008	42/50	16.00+15.02	47/50	6.00+2.44	32/50	36.00+5.49	36/50	28.00+4.96	34/50	32.00+5.49	32/50	36.00+5.49	39/50	22.00+4.47

Table 33. Insecticide resistance in *Bemisia tabaci* populations to various insecticides

Location	Thiomethoxam		Imidacloprid		Monocrotophos		Acephate		Triazophos		Cypermethrin		Endosulfan	
	No dead/ No tested	% Survival ±SE	No dead/ No tested	% Survival ±SE	No dead/ No tested	% Survival ±SE	No dead/ No tested	% Survival ±SE	No dead/ No tested	% Survival ±SE	No dead/ No tested	% Survival ±SE	No dead/ No tested	% Survival ±SE
Trichy	21/30	30.00+5.31	19/30	36.67+5.57	24/30	20.00+4.41	25/30	16.67+4.05	25/30	16.67+4.05	24/30	20.00+4.41	25/30	16.67+4.05
Pudukkottai	23/30	23.33+4.74	26/30	13.33+3.64	25/30	16.67+4.05	24/30	20.00+4.41	25/30	16.67+4.05	24/30	20.00+4.41	23/30	23.33+4.74
Dharmapuri	18/30	40.00+6.03	19/30	36.67+5.81	22/30	26.67+5.04	23/30	23.33+4.74	24/30	20.00+4.41	21/30	30.00+5.31	23/30	23.33+4.74
Madurai	26/30	13.33+3.64	29/30	3.33+1.85	25/30	16.67+4.05	25/30	16.67+4.05	24/30	20.00+4.41	23/30	23.33+4.74	26/30	13.33+3.64
Erode	23/30	23.33+4.74	25/30	16.67+4.05	27/30	10.00+3.17	23/30	23.33+4.74	23/30	23.33+4.74	24/30	20.00+4.41	25/30	16.67+4.05