Plant Archives Vol. 14 No. 1, 2014 pp. 285-288 *ISSN 0972-5210*

FIELD EVALUATION OF ENTOMOPATHOGENS AGAINST LEAF MINER, *APROAEREMA MODICELLA* (DEVENTER) (GELECHIIDAE : LEPIDOPTERA) IN GROUNDNUT

M. Pazhanisamy* and Y. Hariprasad

Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalai Nagar (Tamil Nadu), India.

Abstract

The bioefficacy of entomopathogens *viz*., *B. thuringiensis, Beauveria bassiana, Metarhizium anisopliae* and SlNPV (Spodoptera litura Nuclear Polyhedral Virus) were evaluated against, *A. modicella* of groundnut during *Kharif* 2010 and 2011 at farmer field, Jayankondam, Ariyalur District of Tamil Nadu (India) with nimbicidine as check. All the treatment was found effective in suppressing *A. modicella* population when compare to untreated control. In comparison to check (Nimbicidine), entomopathogens were inferior in reduction of per cent mortality against *A. modicella*. Among the different entomopathogens after first and second round of application revealed that maximum mean per cent mortality was observed in *B. thuringiensis* (49.12% and 53.47%), which was on par with *B. bassiana* (43.97% and 39.71%) during *Kharif* 2010. Similar trend was also observed in *Kharif* 2011 indicating the pathogenicity of *B. thuringiensis* (56.67% and 49.24%) and *B. bassiana* (42.86% and 43.81%) tested against *A. modicella*. Whereas, less mortality was recorded in SLNPV and *M. anisopliae* treated plot in both season.

Key words : *Aproaerema modicella*, field evaluation, entomopathogens, groundnut.

Introduction

Groundnut is grown on nearly 23.95 million ha worldwide with the total production of 36.45 million tons and an average yield of 1520 kg/ha in 2009. India is the second largest producer of groundnut after China. Groundnut accounted for 35.99 per cent of the oilseeds production of the country during 2007-08. Gujarat is the largest producer contributing 25 per cent of the total production followed by Tamil Nadu (22.48 per cent), Andhra Pradesh (18.81 per cent), Karnataka (12.64 percent) and Maharashtra (10.09 per cent) during 2006-07. In Tamil Nadu, groundnut is the major crop under oilseeds accounting for 10.3% of the total cropped area in the state during 2005-2006. It is raised as both rain-fed as well as irrigated crop. Thiruvannamalai, Vellore, Villupuram, Namakkal, Erode and Salem districts constitute 54.9% of the area under groundnut in the state during 2005-2006 (Anonymous, 2006).

Groundnut is attacked by many insect pests. Among them, leaf miner, *Aproaerema modicella* (Deventer) is an important and economic pest of groundnut. *A. modicella* infestations are most serious, when they damage the growing points of young plants, thereby reducing growth and pod yield (35% to 44% lower) (Shanower *et al*., 1995). The indiscriminate use of insecticides has given rise to resistance of the pest species (Georghiou and Lagunes-Tejeda, 1991), besides environmental hazards. Hence, it was felt necessary to search for alternative and effective methods against *A. modicella*. Keeping this in view, the present studies were conducted under field conditions to evaluate the different entomopathogens against this pest to provide the organized guidance for the selection of entomopathogens in order to develop suitable strategy for its management.

Author for correspondence : E-mail: mpsamy26@rediffmail.com

Materials and Methods

Field experiment was undertaken at Jayankondam, Ariyalur District of Tamil Nadu during 2010 -2011 to study the bioefficacy of entomopathogens against leaf miner, *A. modicella* (Deventer) in groundnut. The experiment was laid out in randomized block design with three replications. Groundnut variety, VRI-2 was sown with spacing of 30 × 10 cm in plot size of 20 m^2. FYM @ 12.5 t per ha and NPK fertilizers 10:10:45 kg per ha were

Table 1 : Bio-efficacy of entomopathogens against *A. modicella* on groundnut during Kharif 2010 at Jayankondam, Ariyalur District, Tamil Nadu (Season I).

Treatment	Dose (per liter)	PTC	Per cent mortality over control*							
			First spray				Second spray			
			3DAT	7DAT	15DAT	Mean	3DAT	7DAT	15DAT	Mean
M. anisopliae	1x 10^8 CFU/ml	12.30	21.53^d (27.65)	21.96^d (27.95)	19.96^e (27.95)	21.15	24.10^d (29.40)	26.06^d (30.70)	24.10^d (29.40)	24.75
SLNPV	1×10^8 POBs/ ml	12.50	20.41^e (26.81)	20.33e (26.80)	20.86^d (26.89)	20.53	20.33^e (26.72)	23.06^e (28.70)	21.10^e (27.34)	21.49
Beauveria bassiana	1×10^7 CFU /ml	12.80	40.54^c (39.50)	44.53^c (41.86)	46.86^c (41.86)	43.97	42.03^c (40.41)	40.96^c (39.79)	36.16^c (36.97)	39.71
Bacillus thuringiensis	2.0 gm/l	11.90	48.49^b (44.13)	50.46^b (45.26)	48.43^b (45.26)	49.12	54.23^b (47.33)	56.03^b (48.46)	50.16^b (45.04)	53.47
Nimbecidine	2.0ml/l	12.50	78.53^a (62.52)	82.66^a (65.41)	77.31^a (65.41)	79.50	90.93^a (72.56)	78.33^a (62.27)	84.23^a (66.61)	84.49
Control	-	12.41	0.00^f (0.641)	0.00^f (0.641)	0.00^f (0.641)	0.00	0.00^f (0.641)	0.00^f (0.641)	0.00^f (0.641)	0.00
SEd			0.441	0.496	0.454		0.721	0.585	0.370	
CD (0.01)			1.315**	1.478 **	1.353**		2.146**	1.742**	1.102**	

PTC = Pre - Treatment count, DAT = Days after Treatment, ** significant at 1% level.
* Mean of four replications, figures in parentheses are arcsine (x + 0.5) transformed values, means in column followed by a common letter are not significantly different at the 5 per cent level (DMRT)

applied. All the recommended agronomic practices were followed as per the package of practices. All the treatments (table 1) were imposed using high volume knapsack sprayer and the population of *A. modicella* was recorded one day before spraying and 3, 7 and 15 days after treatment (DAT) on ten randomly selected and tagged plants per plot. The data collected were subjected to statistical analysis using AGRES and AGDATA software.

Results and Discussion

Field evaluation of entomopathogens for control of *A. modicella* under field condition

Season I

The results of the preliminary field experiment conducted during *kharif* 2010 at Variyankaval, Jayankondam, Ariyalur District of Tamil Nadu to test the efficacy of pathogens like *B. thuringiensis*, *B. bassiana*, *M. anisopilae* and SLNPV against *A. modicella* are given in table 1. The results were statistically significant among the treatments. After first spray maximum per cent mortality was recorded in *B. thuringiensis* (48.49%) followed by *B. bassiana* (40.54%) after 3 DAT whereas, chemical check nimbecidine which was recorded 78.53% larval mortality. However, *M. anisopliae* (21.53%) and SLNPV (20.41%) recorded less mortality.

At 7 DAT, *B. thuringiensis* recorded significantly more per cent larval mortality (50.46%) followed by *B. bassiana* (44.53%). Whereas, low per cent mortality was noticed in *M. anisopliae* (21.96%) and SLNPV (20.33%).

At 15 DAT, less mortality was recorded in *M. anisopliae* (19.96%) and SLNPV (20.86%) after first spray. The moderate mortality was shown with *B. thuringiensis* (48.43%) followed by *B. bassiana* (46.86%). Whereas maximum mortality was responded with standard check nimbecidine 2 ml/l (77.31%).

Overall the results after first spray indicate that *B. thuringiensis* @ 2gm/l followed by *B. bassiana* @ 1×10^7 CFU/ml responded maximum mortality i.e., 49.12%, 43.12%. Whereas, less mortality was responded with *M. anisopliae* (21.15%) followed by SLNPV (20.53%). However all treatments were significantly inferior to chemical check (nimbecidine) which was recorded 79.50 per cent mortality.

Similar trend of per cent mortality was noticed on second spray of entomopathogens against *A. modicella.* The maximum mean per cent mortality reduction of *A. modicella* population was observed over the two sprays with nimbecidine followed by *B. thuringiensis* and *B. bassiana*.

Table 2 : Bio-efficacy of entomopathogens against *A. modicella* on groundnut during Kharif 2011 at Jayankondam, Ariyalur District, Tamil Nadu (Season II).

Treatment	Dose (per liter)	PTC	Per cent mortality over control*							
			First spray				Second spray			
			3DAT	7DAT	15DAT	Mean	3DAT	7DAT	15DAT	Mean
M. anisopliae	1x 10^8 CFU/ml	9.34	19.56^d (26.25)^e	23.10^d (28.72)	21.63^d (27.71)	21.43	20.42^d (26.85)	25.36^d (30.24)	23.43^d (28.95)	23.07
SLNPV	1×10^8 POBs/ ml	9.52	17.46 (24.70)	20.26^e (26.75)	16.22^e (23.75)	17.98	20.11^d (26.44)	22.16^e (28.08)	20.36^e (26.82)	20.87
Beauveria bassiana	1×10^7 CFU /ml	9.42	44.20^c (37.70)	44.20^c (41.67)	40.26^c (34.38)	42.86	49.36^c (44.87)	40.15^c (39.30)	41.93^c (40.35)	43.81
Bacillus thuringiensis	2.0 gm/l	8.80	69.36^b (56.39)	49.53^b (44.73)	45.13^b (42.20)	56.67	53.26^b (46.87)	50.12^b (45.07)	44.36^b (41.76)	49.24
Nimbecidine	2.0ml/l	9.10	72.40^a (58.31)	85.20^a (67.40)	80.56^a (63.86)	79.38	86.33^a (68.31)	84.00^a (66.42)	77.50^a (61.68)	82.61
Control	-	9.24	0.00^f (0.641)	82.61 (0.641)	0.00^f (0.641)	0.00	0.00^e (0.641)	0.00^f (0.641)	0.00^f (0.671)	0.00
SEd			0.180	0.575	0.446		0.348	0.401	0.367	
CD (0.01)			0.536**	1.714**	1.330**		1.038**	1.194**	1.094**	

PTC = Pre - Treatment count, DAT = Days After Treatment, ** significant at 1% level

* Mean of four replications, figures in parentheses are arcsine (x + 0.5) transformed values, means in column followed by a common letter are not significantly different at the 5 per cent level (DMRT)

Season II

The result of confirmatory field trial was conducted during *kharif* 2011 (table 2). After first and second spray revealed that maximum *A. modicella* mean per cent mortality was noticed at 3 DAT in *B. thuringiensis* (69.31%, 54.23%) followed by *B. bassiana* (44.20%, 49.36%). Whereas, standard checks nimbecidine treated plot was recorded with 72.40% and 86.33% mortality over control. However M. *anisopliae* (19.56, 20.42%) and SLNPV (17.46, 20.11%) recorded less mortality.

Significantly maximum per cent larval mortality were recorded in *B. thuringiensis* followed by *B. bassiana* (49.53%, 50.125), (44.20%, 40.15%) at seven days after first and second spraying, respectively. However, SLNPV (20.26, 22.16%) and *M. anisopliae* (23.10, 25.36%) recorded less mortality.

After first and second spray at 15 DAT indicated that less mortality was recorded in SLNPV (17.98% and 20.87%), which was on par with *M. anisopliae* (21.43% and 23.07%). While moderate mortality was shown with *B. thuringiensis* (56.67% and 49.24%) followed by *B. bassiana* (42.86% and 43.81%). However maximum mortality was responded standard check with nimbecidine 2 ml/l (79.38% and 82.61%). In overall both spray, the highest percent mortality observed in nimbecidine followed by *B. thuringiensis* and *B. bassiana* was highly pathogenicity to *A. modicella* as compared to other treatments.

In the present investigation, *B. thuringiensis* and *B. bassiana* were also very effective in reducing leaf miner infestation on crop. The efficacy of *B. thuringiensis* and *B. bassiana* are similar to the reports of Narayanwal (1998) and Anonymous (1997). These observation are accordance with those of Muthaiah (2001) who tested that application of reduced concentration of *Bacillus thuringiensis* var *kurstaki* (175 gm/ha) was effective on GLM. According to Shankar also observed in significant reduction of *A. modicella* larva when treated with Biobit (*B. thuringiensis*, var kurstaki) was on a par with dimethoate in its efficacy against *A. modicella* larvae and the crop's pod yield. Applying of *B. thuringiensis* @ 1000ml/ha, *B. bassiana* @ 1×10^7CFU/ml resulted in the maximum reduction of *A. modicella* population was coincided with Dattatray Shirale *et al.* (2010). It was reported that are reduce the leaf miner infestation significantly over control. According to Ranga Rao and Reddy (1997) reported three pathogens *viz.*, *Beauveria bassiana* (Vuille), *Metarrhizium anisopliae* (Metschnioff) and *Aspergillus flavus* (Von Tiegh) cause diseases on groundnut leaf miner. These findings are similar to the reports of Kamesh Rao and Nageshwara Rao (1990) evaluated a formulation of *B. thuringiensis* against leaf miner and reported it to be effective as that of insecticides.

References

Anonymous (2006). *Season and Crop Report 2005-06*. Department of Economics and Statistics, Government of Tamil Nadu, Chennai, Tamil Nadu, India.

Anonymous (1997). Summary of results of entomological trial conducted during Kharif 1996. Project Coordinators Report (1996-97), AICRP on Soybean, National Research Center for Soybean, Indore, India, 220 PP.

Georghiou, G. P. and A. Lagunes-Tejeda (1991). *The Occurrence of Resistance to Pesticides in Arthropods*, FAO, Rome.

Muthaiah, C. (2001). Effect of *Bacillus thuringiensis* against leafminer (*Aproaerema modicella*) in groundnut intercropping system. *Indian Journal of Agricultural Sciences*, **71(5)** : 348-350.

Narayanwal, M. N. (1998). Integration of bioagents and chemical insecticides in the management of major insect pests of soybean. *M.Sc. (Agri.) Thesis*, submitted to Marathwad Agril. University, Parbhani.

Ranga Rao, G. V. R. and P. M. Reddy (1997). *Metarrhizium anisopliae* (Metschn): a potential biological agent for groundnut leafminer. *International Arachis Newsletter,* **17** : 48-49.

Shankar, G., S. Mallikarjunappa and Ganesh Bhat (1993). Comparative bio-efficacy of certain promising insecticides against groundnut leaf miner. *Aproaerema modicella* Dev. *Pestology*, **27** : 21- 24.

Shanower, T. G., A. P. Gutierrez and J. A. Wightman (1995). Impact of the groundnut leafminer, *Aproaerema modicella* (Deventer) (Lepidoptera : Gelechiidae) on growth and yield of two groundnut cultivars. *Insect Science and its Application*, **16(1)** : 87-91.

Thamaraikannan, M., G. Palaniappan and S. Dharmalingam (2007). Groundnut: the King of Oilseeds. In: *Market Survey*. Department of Commerce, Sri Vasavi College, Erode, Tamil Nadu, India. pp. 19-24.