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EXTENT OF SUPPRESSION OF LEAF FOLDER, *CNAPHALOCROCIS MEDINALIS*, GUEN. POPULATION BY SOME SELECTED INSECTICIDES IN THE FIELD OF SCENTED LOCAL PADDY CULTIVAR *TULAIPANJI* AT RAIGANJ, UTTAR DINAJPUR, WEST BENGAL, INDIA

Kaushik Chakraborty[1] and Debes Chandra Deb[2]

[1]Department of Zoology, Alipurduar College, Alipurduar, Jalpaiguri, 736122. West Bengal, India
[2]Department of Zoology, University of North Bengal, Raja Rammohanpur, Darjeeling, 734013 West Bengal, India

ABSTRACT : Extent of suppression of paddy leaf folder population by seven selected insecticide formulations were carried out in the field of local paddy cultivar *Tulaipanji* during four consecutive *autumn-crop* seasons of 2007-2010 at Raiganj, Uttar Dinajpur, West Bengal, India. Experiment was laid out in randomized block design and had five replications for each year. All the treatments were effective significantly to suppress adult individuals/ trap (LFA), larval individuals/hill (LFL) and the incidence of damaged leaf (DL%). Least number of LFA, LFL and DL were noted in imidacloprid 17.8 SL (100ml/ha) treated field. This was followed by carbofuran 3G (30 kg/ha), fipronil 0.3G (750 ml/ha), monocrotophos 36 WSC (1125 ml/ha), propenphos 50 EC (500 ml/ha), clopyriphos 20EC (1875 ml/ha) and bifenthin 10 EC (500 ml/ha) in ascending order. Extent of suppression of adult individuals, larval population and the degree of damage was maximum in imidacloprid 17.8 SL treated plots (83.23% LFA, 85.45% LFL and 89.61% DL). This was followed by carbofuran 3G, fipronil 0.3G, monocrotophos 36 WSC, propenphos 50 EC and chlopyriphos 20 EC respectively in descending order. The minimum suppression efficacy was recorded in bifenthrin 10 EC treated plot (35.98% LFA, 35.98% LFL and 48.07% DL).
Key word: *Tulaipanji*, yellow stem borer, yield loss, pesticide formulations

INTRODUCTION

Though insect pests have been regarded as an important constrain in paddy cultivation through the centuries, occurrence of pest outbreaks have increased with the change of pest complexities, in the last four decades (Ahmed *et al*., 2010). Paddy leaf folder is one of the most important insect pests in Indian subcontinent (Gunathilangaraj *et al.,* 1986)**.** Out of the eight species of leaf folder, the most widespread and important one is *Cnaphalocrocis medinalis* (Guenee) (Bhatti *et al*., 1995). *C. medinalis* (LF) has been reported to attain the major pest status in some important paddy growing areas of India (Maragesan *et al*., 1987). Second instar LF larvae glues the growing paddy leaves longitudinally for accommodation and feeds on green foliage voraciously which results in papery dry leaves (Khan *et al*., 1989). Loss incurred to the growing paddy crop is insurmountable (Ahmed *et al*., 2010). Feeding often results in stunting, curling or yellowing of plant green foliage (Alvi *et al*., 2003). Bhanu *et al.* (2008) from India have reported that in favorable conditions LF affected the crop adversely resulting in severe loss. The extent of loss may extend up to 63 to 80 percent depending on agro-ecological situations as reported by Rajendran *et al*. (1986).

Severe infestations may annihilate the plant totally (Mishra *et al*., 2006). Recurrent grain loss due to this pest attack is a reported phenomenon from the Southern parts of Asia (Kraker *et al*., 1999)**.** For this reason in Asia, more than 25 per cent of applied pesticides are aimed to this pest in a year (Heong *et al*., 1997). In Sri Lanka, LF affects roughly 20 per cent of the total paddy field (Nugaliyadde *et al*., 1997). In average, *C. medinalis* is responsible for 12 to18 per cent crop damage in the northern parts of West Bengal (Biswas*,* 2006). The district Uttar Dinajpur is located in the lower part of the northern districts of West Bengal and offers a congenial environment for paddy cultivation. But no works relating to the dynamics of LF population and the pest suppression efficacy of different pesticide formulation was carried out earlier.

Tulaipanji is supposed to be one of the archaic indigenous aromatic rice varieties which are being cultivated in some native 'pocket' villages covering the block Raiganj of the district Uttar Dinajpur, West Bengal, India (Sen *et al*., 2005). It is basically a low yielding cultivar and claims no 'special management' strategy (Sen *et al*., 2008). But extensive cultivation of local scented cultivars due to high market demand with the input of high doses of inorganic N fertilizer has created an environment that is conducive for insect pest growth and multiplication (Raju *et al*., 1990). In general, higher the pest infestation higher would be the rate of pesticide input to check crop loss in conventionally cultivated fields (Das *et al*., 2010). However suitable pesticide application strategy for this cultivar is yet to be defined. In this contemplation relative efficacy of seven selected pesticide formulations in suppressing *C. medinalis* population was tested in the field of *Tulaipanji* at Raiganj, Uttar Dinajpur, West Bengal where no experiment even of preliminary in nature was carried out earlier. Selection of the pesticides was done only depending on their availability to the farmers.

MATERIAL AND METHODS

Experimental layout: Field experiment was conducted with transplanted seedlings of the local cultivar *Tulaipanji* during four consecutive *autumn-crop* season of 2007-2010 at Raiganj [26º35´15´´(N) – 87º48 ´37´´(W)], Uttar Dinajpur, West Bengal. The soil of the field was sandy loam with PH value 6.7 and EC value 0.29 mhs/cm. Field N, P_2O_5 and K_2O was 274,79 and 380 kg/ha respectively. Experiment was conducted by randomized block design. 30-day old seedlings of *Tulaipanji* were transplanted at the rate 6 seedlings/hill and at 15x10 cm hill-hill spacing. There were seven treatments, each with five replications for each year. For the purpose of pesticide application table no.1 was followed. Field without pesticide treatment was considered as control. Each plot was 50x50 m by size. Pesticide formulation was applied at two specific times, at 40 and 80 days after seedling transplantation (DAT) respectively. Fertilizer inputs and other necessary field management for all the plots were done in due course of time following the national protocol with minor modifications.

Table1: Pesticide formulation, type and the application dose

Treatments	Generic name	Type	Applied dose/ha
T1	Fipronil	0.3 G	0.045 kg
T2	Propenphos	50EC	500ml
T3	Bifenthrin	10 EC	500 ml
T4	Chlopyriphos	20EC	1.875ml
T5	Monocrotophos	36 WSC	1125 ml
T6	Carbofuran	3 G	1.0 kg
T7	Imidacloprid	17.8 SL	100ml
T8 (no application)	-	-	-

(-): no applicable

Assessment of leaf folder population: Incidence of both adult (LFA) and larval leaf folder population (LFL) in relation to the extent of leaf damage (DL) under different schedule of treatments was assessed in following ways:

In consideration of adult population: Assessment of LFA population was done by light trapping. Inexpensive *kerosene* light trap designed by the entomological department, IRRI was used for LF assessment with befitting modifications (Entomology department IRRI, 1979). The light source of the original trap was replaced by 200 watt incandescent light for practical utility. Such 2 light traps were equidistantly placed in each paddy field , 6m above the ground level with a collection pan (r=35 cm.) having emulsified water below each trap. Trapping was done 2-day before (DBA) and 2-day after (DAA) of each date of pesticide application in each plot. The traps were operated from 18:00 to 06:00 hours. Collection from 2 traps was averaged. There were five replications in each year.

In consideration of larval population: Larval population was also noted from each plot at 2-day before and 2-day after pesticide application. At each occasion 10 hills were randomly selected from each plot and from that average incidence of larval population were calculated. There were five replications for each year.

In consideration of the incidence of infestation: Extent of infestation by leaf folder was recorded after counting the number of leaves having more than $^1/_3$ damaged leaf area (DL %). DL (%) was calculated following the formula:

$$\text{DL (\%)} = \frac{\text{Number of damaged leaves} \times 100}{\text{Total number of leaves considered}}$$

Observation was done at two occasions, at 5-day before and 5-day after each date of pesticide application. While recording data, only fresh damage was considered. There were five replications in each year.

In control field same volume of non-insecticidal formulation was applied. Assessment in the control field was done also in the same time. From the pre and post count of adult, larva and the degree of leaf damage, the extent of suppression efficacy of pesticide formulation was determined in percentage.

RESULTS AND DISCUSSION

Extent of suppression of paddy leaf folder adult population (LFA), leaf folder larval (LFL) incidence and the extent of leaf damage (DL%) by seven selected pesticide formulations were carried out in the field of paddy cultivar *Tulaipanji* during four consecutive winter crop seasons of 2007-2010 at Raiganj, Uttar Dinajpur, West Bengal, India. The results are delineated below:

In consideration of adult leaf folder individuals/ light trap (Fig 1, Table 2): In relation to the date of pesticide application and seedling transplantation, trapping was done at four occasions (i) 35-2, (ii) 35+2, (iii) 75-2, (iv) 75+2 date respectively. The number of LFA trapped and the number of LFL observed at each occasion was expressed as DBA, date before pesticide application (for i + iii) and DAA value, date after pesticide application (for ii + iv) respectively. During the first phase of application, all the pesticide formulations were found prudent in reducing the incidence of LFA, LFL and DL (%). Significant variation in consideration of population suppression efficacy of different pesticide formulation was also noted. Year to year variation was also evicted. Extent of suppression was basically determined in consideration of the reduction of population during post pesticide application counting (DAA).

Lowest number of LFA was scored from T7 field (DBA: 113.12±12.06 and DAA: 10.07±12.13). This was followed by T6 (DBA: 109.09±8.57 and DAA: 48.23±2.23), T1 (DBA: 110.56±5.67 and DAA: 27.56±2.67), T5 (DBA: 109.45±3.47 and DAA: 19.56±3.05), T2 (DBA: 107.21±3.46 and DAA: 48.62±5.11), T4 (DBA: 98.78±3.21 and DAA: 55.71±3.09) and T3 (DBA: 112±9.87 and DAA: 69.76±4.73) in ascending order. The control plot has registered 112±9.87 DBA and 95.76±4.73 DAA (Fig 1).

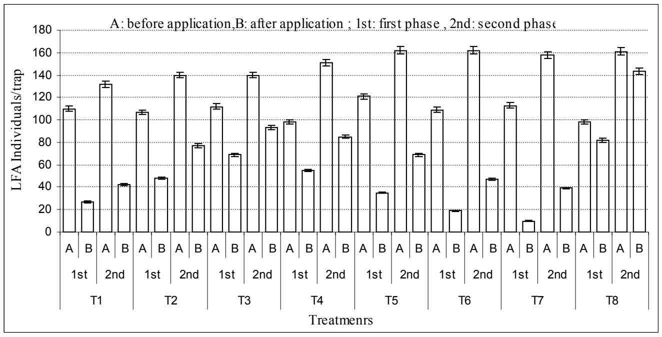

Fig 1. Dynamics of adult population in relation to different phase of pesticide application

Table 2. Extent of suppression of adult and larval population in relation to different phase of pesticide application

Treatment	Adult			Larvae		
	I	II	III	I	II	III
T1	75.45	68.18	71.82	75.45	57.58	66.52
T2	55.14	45.00	50.07	55.14	45.00	50.07
T3	38.39	33.57	35.98	38.39	33.57	35.98
T4	43.88	43.71	43.79	43.88	43.71	43.79
T5	71.07	57.41	64.24	71.07	56.05	63.56
T6	82.57	70.99	76.78	82.57	70.99	76.88
T7	91.15	75.32	83.23	91.15	79.75	85.45
T1	16.33	11.18	13.75	16.35	4.97	10.65
CD(P=0.05)	5.19	6.92	5.61	8.04	7.98	7.45

I: Population suppression during first phase, II: Population suppression during second phase, III: Average value of population suppression in consideration of two application stage

During the second phase of application the lowest LFA was counted from T7 field (DBA: 158.17±10.23 and DAA: 39.12±4.52). This was followed by T6 (DBA: 162.37±10.45 and DAA: 47.73±4.65), T1 (DBA: 132.56±6.09 and DAA: 42.82±6.07), T5 (DBA: 161.77±13.23 and DAA: 69.81±5.77), T2 (DBA: 140.45±12.45 and DAA: 77.08±4.67), T4 (DBA: 151.78±13.45 and DAA: 85.72±6.08) and T3 (DBA: 140.67±17.05 and DAA: 93.42±6.89) in ascending order. The control plot has registered 16±1.87 DBA and 14.76±4.73 DAA.

Grossly, the number of LFA moth caught in the second phase was comparatively higher than the first phase. This might be due the higher growth stage of paddy which supported higher adult population. It is evicted that, for each treatment extent of suppression was higher in the first phase than the second phase in all the years. During first phase of pesticide application highest LFA suppression efficacy was scored for T7 (91.15%). This was followed by T6 (82.57%), T1 (75.45%), T5 (71.07%), T2 (55.14%), T4 (43.88%) and T3 (38.39%) in descending order. During the second phase application, highest suppression efficacy with minimum number of LFA was scored for T7 (75.32%). This was followed by T6 (70.99%), T1 (68.18%), T5 (57.41%), T2 (45.00%), T4 (43.71%) and T3 (35.57%) in descending order. Grossly in consideration of both the phases of application, the extent of suppression in T7 was in average 83.23%. This was followed by T6 (76.78%), T1 (71.82%), T5 (64.24%), T2 (50.07%), T4 (43.79%) and T3 (35.98%) in descending order (Table 2).

In consideration of incidence of larval individuals/10 hills (Fig 2,Table 2): During the first phase application, all the pesticide formulations effectively suppressed the incidence of LFL. Significant variation in consideration of suppression efficacy was also noted. Extent of suppression was determined in consideration of post application counting (DAA) of larval number. Lowest number of LFF was scored for T7 (DBA: 11.43±1.56 and DAA: 1.01±0.45). This was followed by T6 (DBA: 11.02±2.07 and DAA: 1.92±0.49), T1 (DBA:11.12±3.45 and DAA:2.73±0.56), T5 (DBA:12.23±3.49 and DAA: 3.54±0.87), T2 (DBA: 10.82±2.07 and DAA:4.85±0.56), T4 (DBA: 9.91±1.07 and DAA:5.46±1.23) and T3 (DBA:11.32±2.05 and DAA:6.98±1.05) in descending order. The control plot has registered 10±2.11 DBA and 8.92±1.47 DAA.

The number of LFL counted in the second phase was comparatively higher than the first phase. High canopy structure due to higher growth stage of paddy supported higher number of larvae. During the second phase of application the lowest LFL was noted from T7 field (DBA: 15.98±2.09 and DAA: 3.24±0.67). This was followed by T6 (DBA: 16.38±2.52 and DAA: 4.75±0.58), T1 (DBA: 13.35±2.11 and DAA: 5.66±1.45), T5 (DBA: 15.87±2.06 and DAA: 6.98±1.31), T2 (DBA: 14.61±2.76 and DAA: 7.79±3.23), T4 (DBA: 15.27±2.11 and DAA: 8.59±2.87) and T3 (DBA: 14.61±2.38 and DAA: 9.40±1.63) in ascending order. In control plot LFL number was 16±9.87 DBA and 12.16±2.73 DAA respectively (Fig 2). `

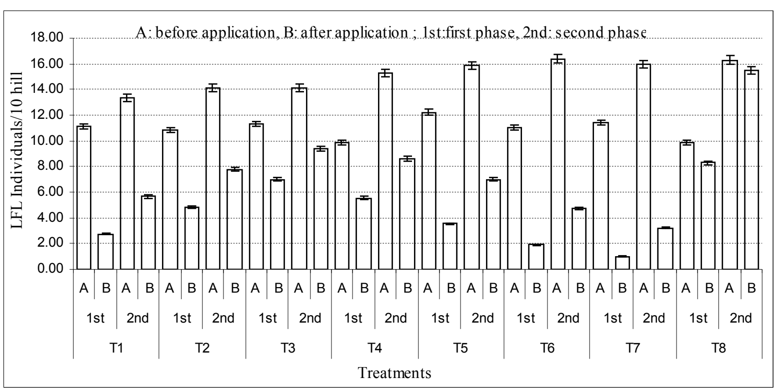

Fig 2. Dynamics of larval population in relation to different phase of pesticide application

Highest LFL population suppression efficacy was scored for T7 (91.65%). This was followed by T6 (82.57%), T1 (75.45%), T5 (71.07%), T2 (55.14%), T4 (43.88%) and T3 (38.39%) in descending order. During the second phase highest suppression efficacy with minimum number of LFL individuals was also registered from T7 field (79.75%). This was followed by T6 (70.99%), T1 (57.58%), T5 (56.05%), T2 (45.00%), T4 (43.71%) and T3 (33.57%) in ascending order. Grossly in consideration of both the phases of application, the extent of larval suppression in T7 was in average 85.45%. This was followed by T6 (76.88%), T1 (66.52%), T5 (63.56%), T2 (50.07%), T4 (43.79%) and T3 (35.98%) in descending order (Table 2).

In consideration of incidence of damaged leaf (Table 3): During the first phase application, all the pesticide formulations have effectively suppressed the incidence of damaged leaf symptoms (DL%). Year to year variation in consideration of the extent of damage was also evicted. Lowest range of damage was scored from T7 field (0.46±0.05). This was followed by T6 (0.83±0.21), T1(1.79±0.56), T5 (1.99±0.87), T2 (2.12±0.26), T4 (2.48±0.87) and T3 (2.56±0.67) in ascending order. The control plot has registered 6.38±1.73 DL (%).

During the second phase application the lowest number of DL was counted for T7 (1.02±0.27). This was followed by T6 (1.64±0.58), T1 (2.38±0.75), T5 (3.61±0.87), T2 (4.22±0.97), T4 (4.73±0.82) and T3 (5.11±1.63) in ascending order. The control plot has registered 112±9.87 DBA and 69.76±4.73 DAA.

Highest suppression of DL (%) was evicted from T7 field (95.17%). This was followed by T6 (92.28%), T1 (83.42%), T5 (81.56%), T2 (80.33%), T4 (77.06%) and T3 (76.31%) in descending order. During the second phase highest suppression efficacy with minimum DL number was scored from T7 (84.05%). This was followed by T6 (74.54%), T1 (64.73%), T5 (43.34%), T2 (33.88%), T4 (25.82%) and T3 (19.82%) in ascending order. Grossly in consideration of both the phases of application, the average extent of suppression of the DL (%) was maximum in T7 (83.31%). This was followed by T6 (62.45%), T1 (74.08%), T5 (62.45%), T2 (57.11%), T4 (51.44%) and T3 (48.07%) in descending order (Table 3).

Table 3. Incidence and the extent of suppression of damaged leaf (%) formation different pesticide formulation during *autumn-rice* season of 2006-2009

Insecticide formulation	Extent of suppression of damaged leaf (DL%)												
	During first phase						During second phase						Extent of population suppression (average of two application stage)
	2006	2007	2008	2009	Mean	Decrease of incidence (%)	2006	2007	2008	2009	Mean	Decrease of incidence (%)	
T1	1.77 (1.51)	1.81 (1.52)	1.79 (1.51)	1.77 (1.03)	1.79 (1.51)	83.42	2.38 (1.70)	2.45 (1.72)	2.30 (1.67)	2.38 (1.70)	2.38 (1.70)	64.73	74.08
T2	2.23 (1.65)	2.03 (1.59)	2.11 (1.62)	2.23 (1.58)	2.12 (1.62)	80.33	4.21 (2.17)	4.25 (2.18)	4.19 (2.67)	4.22 (2.17)	4.22 (2.17)	33.88	57.11
T3	2.41 (1.71)	2.54 (1.74)	2.72 (1.79)	2.41 (1.71)	2.56 (1.75)	76.31	5.11 (2.37)	5.13 (2.37)	5.10 (2.37)	5.11 (2.37)	5.11 (2.27)	19.82	48.07
T4	2.49 (1.73)	2.35 (1.69)	2.59 (1.76)	2.49 (1.73)	2.48 (1.73)	77.06	4.82 (2.31)	4.75 (2.29)	4.62 (2.26)	4.73 (2.29)	4.73 (2.29)	25.82	51.44
T5	1.99 (1.58)	1.89 (1.55)	2.09 (1.61)	1.99 (1.18)	1.99 (1.58)	81.56	3.67 (2.04)	3.49 (2.00)	3.68 (2.04)	3.61 (2.03)	3.61 (2.03)	43.34	62.45
T6	0.90 (1.18)	0.76 (1.12)	0.84 (1.16)	0.90 (1.51)	0.83 (1.51)	92.28	1.63 (1.46)	1.69 (1.48)	1.59 (1.45)	1.64 (1.46)	1.64 (1.46)	74.34	83.31
T7	0.56 (1.03)	0.32 (0.91)	0.49 (0.99)	0.56 (1.73)	0.46 (0.98)	95.17	1.02 (1.23)	1.05 (1.24)	0.98 (1.22)	1.02 (1.23)	1.02 (1.23)	84.05	89.61
T8 (no application)	8.14 (2.94)	8.12 (2.94)	8.89 (3.06)	8.14 (2.94)	8.12 (2.98)	-	6.34 (2.62)	6.56 (2.66)	6.23 (2.62)	6.38 (2.62)	6.38 (2.62)	-	-
SE(±)	0.11	0.33	0.19	0.21	0.12	-	0.21	0.17	0.12	0.19	0.22	-	-
CD (P=0.05)	0.31	0.37	0.41	0.37	0.27	-	0.21	0.23	0.29	0.17	0.25	-	-

(-): Not applicable, Figures in the parenthesis are the square root transformed values

No specific observation on the impact of insecticide formulations on LF incidence in relation to local paddy cultivars was carried out earlier in the northern parts of West Bengal. Works had done elsewhere mostly cover the assessment of superiority of different insecticidal brands and the estimation on seasonal dynamics of LF population in relation to high yielding cultivars. Further such works covers a number of pesticide formulations of newer brands conceiving no single protection protocol applicable for all the regions. Present results partly corroborates to those of Mishra *et al*. (1998) and Kushwaha (1995) who have noted that the population suppression capacity of monocrotophos and cypermethrin was essentially prudent in some regions of India. On the other hand Ramasubbaiah *et al.* (1980) have noted that fenthion, phosphamidin, fenitrothion, endosulphon dimethoate, quinalphos, diazinon and carbaryl could effectively suppress LF menace. Saroja and Raju (1982) have viewed that cypermethrin and fanvalerate are best suitable pesticide to suppress LF population and accordingly to maximize paddy yield. Bhanu *et al.*(2008) have noted considerable variations of the efficacy on pesticides in field condition. Wakil *et al*. (2001) from Pakistan have reported that not all the pesticides were equally effective to check leaf folder attack. Among the batches of pesticides, Panda *et al*. (2004) have noted that fipronil 0.4 G performs well in field condition. Firake *et al.* (2010) from Pantnagar, India have reported that dimilin was the best suitable insecticide to suppress LF menace. This was followed by regent, caldan and confidor in descending order.

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