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Population Trends and Chemical Control of Rice Leaf Folder, *Cnaphalocrocis medinalis* on Rice Crop

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ABSTRACT

Studies on the population dynamics and chemical control of rice leaf-folder, *Cnaphalocrocis medinalis* were conducted at Adaptive Research Farm, Gujranwala during kharif 2000 and 2001. The results indicated that the activity of *C. medinalis* lasted from second week of August to the second week of October during 2000 while it lasted from the last week of August to the second week of October during kharif 2001. The peak of its activity was observed in the second fortnight of September during both the crop seasons. The efficacy of six insecticides, Tamaran 600SL @ 1.25 l. ha^{-1}, Arrivo 10EC @ 0.625 l. ha^{-1}, Denital 10EC @ 1.50 l. ha^{-1}, Malathion 57EC @ 2.50 l. ha^{-1}, Nuvacron 40EC @ 1.25 l. ha^{-1} and Roxion 40 EC @ 0.875 l. ha^{-1} was evaluated against rice leaf-folder. All the insecticides caused 90.2 to 100.0 % mortality of the pest after 24 hours of spray except Malathion which exhibited 76.6 and 80.0 % mortality for the year 2000 and 2001, respectively. Insecticide treated plots invariably yielded higher than the control. The highest yield (3475 kg ha^{-1}) was recorded with Nuvacron application and the lowest with Malathion (3292 kg ha^{-1}) as compared to control (3068 kg ha^{-1}). By calculating the cost benefit ratio for various treatments, the maximum monetary benefit was found for Nuvacron spray (1:7.14) followed by Roxion (1:7.10), Arrivo (1:7.04), Tamaron. (1:5.73), Denital (1:3.12) and Malathion (1:1.91).

Key Words: Insecticides; Rice leaf folder

INTRODUCTION

Rice leaf folder, *Cnaphalocrocis medinalis* (Pyraulidae; Lepidoptera) has attained the status of a major pest in rice growing areas of Punjab. In certain cases it has been recorded to cause 63 to 80 percent yield losses in rice (Rajendaran *et al*., 1986; Muragesan & Chellish, 1987)

The leaf folder damages the crop in its larval stage. The young larvae feed on open leaves but later feed inside the rolled leaf formed by folding the leaf longitudinally with a sticky substance. The larvae chew inside the fold by scraping the green matter. The scraped leaves become membranous, turn whitish and finally wither. A single larva can damage a number of leaves. This activity disturbs the photosynthesis and plant growth and ultimately yield is reduced. The success of the crop, therefore, depends upon effective control of this pest.

Various studies have been conducted by previous workers on the population dynamics and chemical control of leaf folder. Islam *et al.* (1996) found that the relative abundance of rice leaf folder varied with the rice seasons. In six successive seasons, larval population density ranged from 0.00 to 3.34% and caused no serious yield losses. Field studies conducted by Pawan *et al.* (1996) in Bihar, India showed that infestation of rice leaf folder ranged from 1.4 to 33.2% from July to October with minimum level of infestation in July (1.8-2.9%) and maximum in September (17.9-33.2%) followed by August (7.6-16.2%). Khan *et al*. (1989) studied the biology, chemical control and varietal preference of rice leaf folder and found that larval damage and larval population differed significantly among different rice varieties. Application of Lorsban, Sumithion, Methyl Parathion, Denital and Thiodan gave more than 90% mortality of the insect larvae and were statistically at par in controlling the rice leaf-folder. Ramasubbaiah *et al.* (1980) tested fenthion, phosphamidin, fenitrothion, endosulphon dimethoate, quinalphos, diazinon and carbaryl against *C. medinalis* and reported that all insecticides gave effective control. Saroja and Raju (1982) studied the effect of some foliar insecticides against leaf folder and found that cypermethrin and fanvalerate provided effect control and increased the yield of rice significantly.

The objectives of our study were to determine the population trends of *C. medinalis* on rice crop in Gujranwala area and evaluate the efficacy of some insecticides for its control.

MATERIALS AND METHODS

The studies were carried out at Adaptive Research Farm Gujranwala during kharif 2000 and 2001. To determine the population dynamics of *C. medinalis*, rice crop (Basmati super variety) was grown in a field measuring 35m×60m. Fertilizer was applied @ 136-84-62 kg NPK ha^{-1}. No insecticide was applied in this field throughout out the growing season. The field was monitored for leaf-folder infestation weekly from early August to second week of October. The population was recorded by counting the number of insect larvae from

randomly selected 10 plants at three places and calculating average number of larvae per 10 hills.

Six insecticides were evaluated against rice leaf-folder on rice crop (Basmati super variety). The detail of treatments is given as under;

Trade name and formulation	Common name	Dose (L ha^{-1})
Tamaran 600 SL	Methamidophos	1.25
Arrivo 10 EC	Cypermethrin	0.625
Denital 10 EC	Fanvalerate	1.50
Malathion 57 EC	Malathion	2.50
Nuvacron 40WSE	Monocrotophos	1.25
Roxion 40 EC	Dimethoate	0.875
Control		-

The experiment was laid out in a Randomized Complete Block Design with three replications and a plot size of 15m×6m. The crop was transplanted on 17th July in 2000 and 24th of July in 2001. Fertilizer was applied @ 136-84-91 kg NPK ha^{-1}. The insecticides were sprayed with the help of knapsack sprayer when the attack of leaf folder reached two larvae per plant. Mortality of the insect larvae were calculated by counting the number of larvae from randomly selected 10 hills from each treatment 24 hours before and after the application of insecticides. The performance of each insecticide was based on the mortality of the pest after 24 h after spray and the yield. The data were subjected to analysis of variance and the means were compared by least significant difference (LSD) at 5% probability level. Cost-benefit ratios were calculated by dividing the extra benefit attained from enhanced yield by the extra cost incurred for each treatment. The costs included price of insecticides and labour charges for insecticide application.

RESULTS AND DISCUSSION

The population dynamics of rice leaf-folder recorded during kharif 2000 and 2001 is presented in Fig. 1. It is evident from the figure that during kharif 2000 the rice crop remained free from *C. medinalis* infestation till the first week of August. However, in the second week of August the infestation appeared in the form of rolled leaves and presence of larvae and continued to increase gradually towards peak (4.63 larvae hill^{-1}) in the third week of September. Thereafter it decreased and finally disappeared in the second week of October. During kharif 2001, the leaf-folder appeared (0.33 larvae hill^{-1}) in the end of August. Its incidence increased towards peak (4.41 larvae hill^{-1}) in the third week of September and decreased thereafter and was the lowest in the second week of October. These findings are in close proximity to Garg (1984), Khan *et al.* (1989), Rashid (1994) Pawan *et al.* (1996) and Kraker *et al.* (1999) who observed similar population trends with a peak in the month of September. However, our results differ from those of Anuj *et al.* who observed low larval population in the first three months of cropping season, with highest activity in the final week of October.

It might be due to the differences in the method of recording the population data as their results were based on the population recorded from light trap catches.

Data on mortality caused by the insecticides during Kharif 2000 and 2001 is presented in Table I. The mortality of the pest ranged from 76.3 to 100.0% in treated plots. Nuvacron gave the highest (97.6 & 100.0 %) mortality followed by Roxion (93.8 & 96.7%), Tamaron (93.3 & 93.9%), Arrivo (90.2 &93.8%) and Denital (93.1 & 90.5%) for the year 2000 and 2001, respectively. The mortality caused by these insecticides was statistically at par. Malathion gave significantly lower mortality (76.3 & 80.2 % for the year 2000 and 2001, respectively) than the former pesticides. These results are comparable with those of Khan *et al.* (1989) who observed more than 90% mortality of the rice leaf-folder after the application of various insecticides. Our results are in partial agreement with those of Mishra *et al.* (1998) and Kushwaha (1995) who observed that monocrotophos and cypermethrin gave good control of rice leaf-folder and were at par statistically.

All insecticidal treatments significantly out yielded the untreated plots (Table II). The highest paddy yield was obtained with the application of Nuvacron (3475 kg ha^{-1}) followed by Roxion (3444 kg ha^{-1}), Tamaron (3415

Fig. 1. Population trends of rice leaf-folder, *C. medinalis* at Adaptive Research Farm Gujranwala during 2000 and 2001

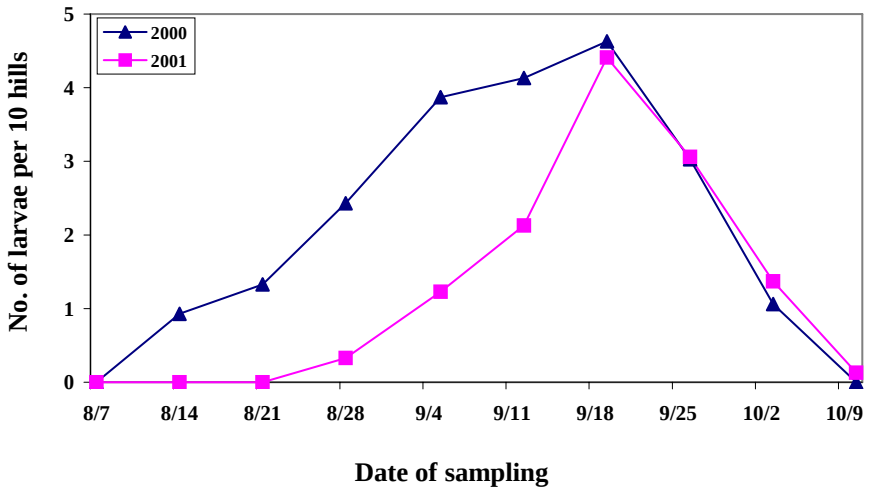

Table I. Effect of various insecticides on the larval population and mortality of rice leaf-folder, *C. medinalis* at Adaptive Research Farm Gujranwala during 2000 and 2001

Insecticide formulation with dose ha^{-1}	Kharif 2000			Kharif 2001		
	Number of larvae			Number of larvae		
	Before spray	After spray	Mortality (%)	Before spray	After spray	Mortality (%)
Tamaran 60 EC @ 1.25 Lha^{-1}.	2.53	0.17	93.3a	2.13	0.13	93.9a
Arrrivo 10EC @ 0.625 L ha^{-1}	1.70	0.17	90.2a	2.73	0.17	93.8a
Denital 10EC @ 1.50 L ha^{-1}	1.93	0.13	93.1a	2.43	0.23	90.5a
Malathion 57 EC@ 2.50 L ha^{-1}	2.57	0.60	76.3b	1.87	0.37	80.2b
Nuvacron 40 EC @ 1.25 L ha^{-1}	3.07	0.10	97.6a	2.23	0.00	100.0a
Roxion 40EC @ 1.00 L ha^{-1}	3.20	0.20	93.8a	2.93	0.10	96.7a
Control	2.00	1.93	3.3c	2.03	0.00	0.0c

Means sharing the same letter do not differ significantly

Table II. Economics of control operations of rice leaf-folder, *C. medinalis* on rice crop at Adaptive Research Farm Gujranwala (Average of kharif 2000 and 2001)

Insecticide formulation with dose ha^{-1}	Yield (kgha^{-1})	Increase in yield over control (kg)	Profit calculated @ Rs.12 kg^{-1}	Cost of insecticide and labour (Rs.ha^{-1})	Net profit (Rs. ha^{-1})	Cost-benefit ratio
Tamaran 60 EC @ 1.25 Lha^{-1}.	3415a	347	4164	619	3545	1:5.73
Arrrivo 10EC @ 0.625 L ha^{-1}	3407a	339	4068	506	3562	1:7.04
Denital 10EC @ 1.50 L ha^{-1}	3411a	343	4116	1000	3116	1:3.12
Malathion 57 EC@ 2.50 L ha^{-1}	3292b	224	2688	925	1763	1:1.91
Nuvacron 40 EC @ 1.25 L ha^{-1}	3475a	407	4884	600	4284	1:7.14
Roxion 40EC @ 1.00 L ha^{-1}	3444a	376	4512	575	4062	1:7.10
Control	3068c	-	-	-	-	-

Means sharing the same letter do not differ significantly

kg ha^{-1}), Denital (3411 kg ha^{-1}) and Arrivo (3407 kg ha^{-1}). These treatments were, however, at par statistically. The yield obtained by the application of Malathion (3292 kg ha^{-1}) was statistically lower than those of other insecticidal treatments. These results are similar to those of Saroja and Raju (1982 a, b) who obtained similar increase in yield by controlling *C. medinalis* damage by the application of synthetic pyrethroids.

The economics of control operations worked out at the current prices of insecticides, labor charges and the cost of paddy rice is given in Table II. Nuvacron application resulted in the highest cost benefit ratio (1:7.14), followed by Roxion (1:7.10), Arrivo (1:7.04), Tamaron (1:5.73), Denital (1:3.12) and Malathion (1:1.91). Thus the economics of insecticidal treatments indicated that the application of Nuvacron, Roxion and Arrivo at the economic threshold level of *C. medinalis* infestation was more profitable. Our results are comparable to those of Mishra *et al*. (1998) and Waqas *et al*. (2001) who reported similar monetary benefits

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