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Impact of Natural Biological Control in Rice Pest Management

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Several workers have studied the natural enemies of important insect pests and generated information on identification and tested the possibility of controlling rice pests. In recent times, there is a growing feeling that natural biological *in situ* itself, if effectively managed, can help in dispensing with the insecticidal application. The knowledge about the effect of natural biocontrol agents in managing rice pests is meagre. Hence, the present study was undertaken to demonstrate and quantify the impact of natural biological control in rice ecosystem.

A field trial was conducted during *kharif* 1994, at the Main Rice Research Station, Gujarat Agricultural University, Nawagam (Gujarat). The trial consisted of two treatments, (i) natural biocontrol plot (NBC) without any insecticide application throughout the crop season and (ii) need based protection (NBP) with insecticides based on periodical pest surveillance considering economic threshold level. The seeds of susceptible variety GR-11 were sown on 29-7-94 and the seedlings were transplanted at 20 cm x 15 cm spacing on 28-8-94. The crop was fertilized with 100 kg N and 50 kg P_2O_5 per hectare.

The plot with a size of 2500 sq. metre under each treatment was divided into five equal sub-plots. Among the two plots (treatments), one plot (NBP) was treated with recommended insecticides, while the other plot (NBC) was kept untreated (check). The granular insecticides, carbofuran (Furadan) 3 G and phorate (Thimet) 10 G were used @ 25 and 10 kg/ha on 40 and 60 days after transplanting (DAT), respectively. A maxiture of phosphamidon (Dimecron) 85 SL and dichlorvos (Nuvan) 76 EC was sprayed each @0.5 kg a.i./ha on 75 DAT.

Based on the status of pest prevalence, attention was focussed mainly upon two major pests of this locality, i.e. white backed plant hopper (WBPH), *Sogatella furcifera* (Horv.) and leaf folder (LF), *Cnaphalocrocis medinalis* Guen. Pest population and damage level were monitored from the four predetermined fixed quadrates of 1 sq. metre in each sub-plot. Fifth sub-plot was kept for sampling purpose. Pest incidence was recorded three times in a season when activity of the

pests was at peak level i.e. in the months of October and November. For the purpose, number of WBPH present on 5 randomly selected hills from each quadrate was recorded. Similarly, leaf folder damage was assessed by counting total number of leaves and LF damaged leaves.

Population of natural biocontrol agents was estimated two times during the crop period. i.e. 85 and 90 DAT. For the purpose, 5 sampling points were randomly selected from each sampling plot. Thereafter, 5 hills were covered quickly at each sampling point with a large polythene bag avoiding esape of any flying insects. Then the hills were cut carefully under water level and lifted the plants covered with polythene bag without any disturbance. A cotton squab soaked in dichlorvos was introduced into the bag to kill all the captured arthropods. The collected fauna were listed and identified based on earlier identified specimens.

The crop was harvested during second week of December. Grain yield was recorded from all the sub-plots per treatment except the plots kept for sampling purpose by excluding two border rows.

The data obtained were subjected to 'T' test analysis.

Data (Table 1) indicated that the number of WBPH ranged from 2.80 to 17.60 with an average of 7.02 hoppers/hill in NBP, the

TABLE 1

Incidence of WBPH and leaf folder in natural biological control trial.

Observation period	*Sub plot No.*	*Av. number of WBPH/hill*		*% leaves damaged by LF.*	
		Treated	*Check*	*Treated*	*Check*
1.	*2.*	*3.*	*4.*	*5.*	*6.*
October '94	1	3.40	5.00	2.58	3.08
I week	2	4.80	4.60	3.68	4.76
	3	2.80	4.60	4.57	2.27
	4	4.00	4.00	6.11	2.07
October '94	1	9.60	16.60	11.11	11.39
IV week	2	14.20	16.80	7.67	10.15
	3	13.80	15.60	11.52	11.21
	4	17.60	15.80	13.95	13.02
November '94	1	3.80	9.60	1.64	13.38
IV week	2	2.80	8.80	3.40	11.38
	3	4.00	11.80	4.86	9.30
	4	3.40	9.00	2.55	9.52
Seasonal mean	—	7.02	10.22	6.14	8.46
'T' test		NS		NS	

NS = Not Significant.

corresponding figures in NBC were 4.40 to 16.80 and 10.22, respectively. Similarly, rice leaves damaged by LF were 6.14 and 8.46 per cent in treated and check plots, respectively. Though, the pest incidence was comparatively low in former treatment than the later, the differences were not enough to prove significant impact of need based chemical means. Anonymous (1994) from Jagdalpur, noted that the difference in LF damage was marginal between that of natural biocontrol plot and need based protection with insecticide treated plots. This is in close agreement with the present finding.

The coccinellids (mainly *Menochilus secmaculatus* Fab. *Coccinella septempunctata* Lin. and *Coccinella arcuata* Fab) and staphylinids (*Paederus fuscipes* Curtis) were found active predators of hoppers in rice field. The population of coccinellids/lady bird beetles (LB) and staphylinids (ST) was significantly low in insecticidal treated plots in comparison to untreated plots (Table 2). This explains that toxic chemicals applied against crop pests had adverse effect on beneficial fauna. Suvaparp (1992) also opined that insecticides when applied are detrimental to both pest species and natural enemies.

About 6 species of predatory spiders (PS) were observed preying on *S. furcifera*. The species, *Tetragnatha fletcheri* Gravaly,

TABLE 2

Number of biocontrol agents in insecticide treated (T) and untreated (UT) plots.

Observation period	*Sub plot No.*	*LB*		*ST*		*PS*		*PB*	
		T	*UT*	*T*	*UT*	*T*	*UT*	*T*	*UT*
1.	*2.*	*3.*	*4.*	*5*	*6.*	*7.*	*8.*	*9.*	*10.*
85 DAT	1	6	18	0	9	6	8	0	4
	2	11	37	6	5	7	12	0	0
	3	32	31	6	6	9	6	0	2
	4	22	33	11	14	7	7	0	0
	5	17	8	9	2	16	5	0	1
90 DAT	1	14	39	11	9	10	12	6	10
	2	13	33	16	24	9	13	0	9
	3	12	48	16	13	10	16	9	0
	4	9	28	15	9	10	13	0	16
	5	9	20	12	16	9	7	0	20
Mean		15.0	29.5	10.2	10.7	9.4	9.9	1.5	6.2
Calculated Value	't'	4.522**		2.805*		NS		NS	

*Significant at 5%. NS = Not Significant

** Significant at 1%

Phiddipus sp., *Lycosa poonaensis* Tikader, *Thomisus projectus* Tikader, *Oxyopes ratanae* Tikader and *Argiope anasula* Thorell were most common in rice field. The population of predatory spiders was more or less the same in both the treatments. Anonymous (1994) found that the population of predatory spiders in rice var. 'Kranti' was abundant in both (insecticide treated and untreated) the plots and had no discernible impact on pest damage, support the above results, however, population of predatory ground beetles was high in NBC compared to that of NBP.

Presence of the same level of PS population in both the treatments under study may be due to less side effect of granular insecticides. According to Kiritani *et al.* (1972), spiders were less affected by applications of granular formulations than by the conventional treatments. Kim *et al.* (1984) recorded more than double population of spiders preying on plant hoppers even with the use of 2 applications of carbofuran compared with the usual insecticide treatments. These reports are in conformity with the above finding.

The activity of pentatomid predatory bug (PB), *Andrellus spinidens* Fab. was most abundant in NBC plot than the NBP, but without statistical difference. The counts of larval and pupal parasites (those emerged out from sampling) of rice pests i.e. *Apanteles* sp., *Brachymeria lasus* (Walker), *Charops* sp., *Xanthopimple* sp. and *Goniozus* sp.) were very few in thier numbers in both the treatments and hence not presented in table.

Need-based insecticide treated plots yielded 99.6 kg (25.94 q/ha) grain and 129.6 kg (33.75 q/ha) fodder yield per plot as against 51.5 kg grain and 87.25 kg fodder yield in natural biocontrol plot (Table 3). Despite increase in grain (93.4%) and fodder (48.6%) yield in case of NBP over NBC, the yield values in both the

TABLE 3

Grain and fodder yield (kg) recorded in insecticide treated and untreated plots (384 m^2).

Sub-plot No.	*Grain*		*Fodder*	
	T	*UT*	*T*	*UT*
1	109.0	45.0	136.0	77.0
2	103.0	52.0	130.5	88.0
3	104.0	48.0	120.0	81.0
4	82.5	61.0	132.0	103.0
Mean	99.63	51.50	129.63	87.25
'T' test	NS		NS	

NS = Not Significant

treatments were at par. Feijen (1977), based on the ecological studies of natural enemies of rice borers, concluded that there was no significant difference in yield between sprayed and unsprayed fields. This is in accordance with the present investigation.

From the above it can be concluded that satisfactory control of pests requires a combination of the use of natural enemies supplemented by the judicious use of insecticides. A rationalized application of insecticide fitting into the scheme of an IPM programme should be selected. This approach needs a greater knowledge of the ecology of existing natural enemies in target areas and hence conservation of natural biocontrol agents in rice ecosystem is essential for minimising pest infestation and reducing the cost of insecticides.

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