CARRYOVER AND POPULATION BUILD-UP OF INSECT PREDATORS IN RICE-WHEAT SYSTEM

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ABSTRACT

Carryover and population build-up of predators of insect pests in rice-wheat system were studied under zero tillage and conventional wheat planting methods at Muridke (District Sheikhupura) and Bhalwal (District Sargodha). Population of predators at both the sites remained high throughout the study period in wheat fields sown with zero-till drill than the wheat fields sown conventionally. Populations of spiders and rove beetles *(Paederus fuscipes* Curt) were significantly higher than the remaining species of the predators. The magnitude of the difference in the populations of predators between zero tillage and the conventional method of sowing of wheat increased with the passage of time at both the sites. Such difference was less during the first year (2003), but increased in the second year (2004) and the third year (2005).

Key words: predators of insect pests, rice, spiders and rove beetles

INTRODUCTION

Insect predators and parasitoids could keep the insect host population under check in the areas where indiscriminate use of pesticides is avoided. Insect predators of rice pests occur in almost all the rice growing areas and play a significant role in reducing the pest population. Beetles, predatory grasshoppers, and crickets may consume 80-90% of the eggs of certain insect pests (Ramzan *et al*., 2006). A large number of the staphylinids in rice fields feeding on nymphs of *Sogatella furcifera* (Horv.) have been recorded (Shukala *et al.*, 1983). Population densities of Tetragnathidae and Staphylinidae have been found widespread (Salim, 2002). Barrion (1980) reported ants preying on larvae of *Cnaphalocrocis medinalis* (Gn.), particularly *Diacamma* spp. Barrion and Litsinger (1981) recorded for the first time a new spider *(Hippasa holmerae* Th.) preying on rice plants infested with brown and white backed plant hoppers and green leafhoppers.

More than 40 species of predators of rice insect pests have been recorded in Pakistan including spiders, rove beetles and coccinellids, which play an important role in suppressing population of the pests in the ecosystems (Salim, 2001). The parasites and predators attacking rice insect pests in Pakistan have been enlisted (Srivastava et.al, 2005) but scanty information is available on the predators' population dynamics and carryover in zero tillage rice-wheat cropping system. The present paper presents the effect of zero tillage on the carryover and population build-up of predators of insect pests of rice-wheat system.

MATERIALS AND METHODS

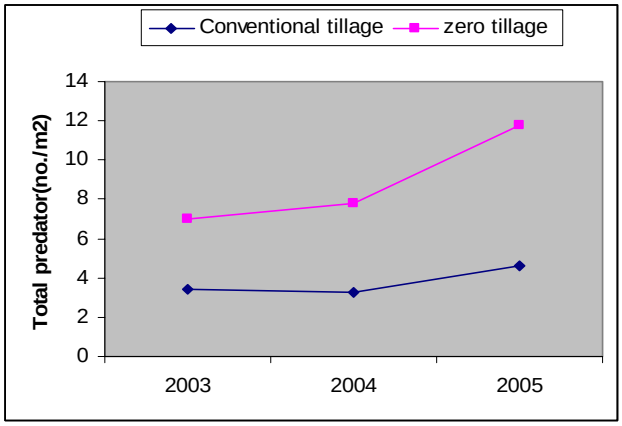
Carryover and population build-up of the predators of insect pests in the rice-wheat system under zero tillage and conventional tillage were determined through field experiments at Muridke (Distt. Sheikhupura) and Bhalwal district (Sargodha) during 2002-2005. Sampling was carried out in four replications in a plot size of 0.4 ha with randomized complete block design. Population of flying predators such as *Conocephalus longipennis* and *Agriocnemis* spp. in rice crop was recorded from five sampling sites where each sampling site consisted of 20 sweep strokes. In wheat, population of spiders, *Coccinelids, Ophionea, Paedirus* spp was recorded by visual counting from five sampling sites each, consisting of one m^2 selected randomly in each field. Various species of predators such as A*raneae*, coccinelids, rove beetles and *Ophionea nigrofasciata* were recorded from rice stubbles during winter.

RESULTS AND DISCUSSION

The population of predators remained comparatively higher in wheat fields sown with zero-till drill (without seed-bed preparation) than those of conventionally sown wheat fields at both the sites and the crops throughout the study period. Conservation of predators' populations seems possible for the management of insect pests in rice-wheat system.

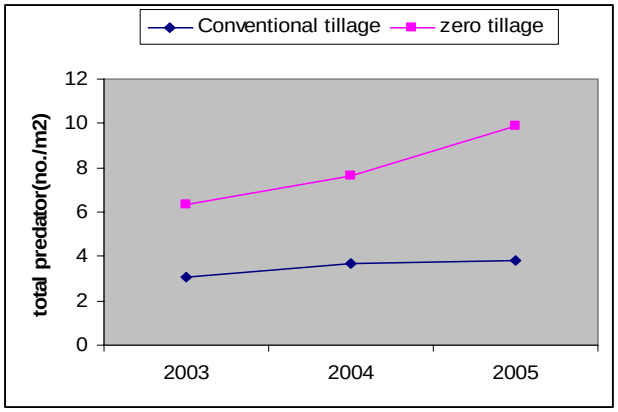
Population and Species Variation in Wheat: Population of predators in zero-till wheat sown fields at Muridke was 6.97, 7.83 and 11.76 per m^2 during 2003, 2004, 2005 respectively; that is two times the population of the conventional tillage (Fig. 1). Predators' population

at Bhalwal site in zero-till wheat fields was 6.32 during 2003 and increased gradually to 7.67 and 9.9 per m^2 during 2004 and 2005 respectively. At both the sites, the conventional wheat fields had same number of predators



Muridke

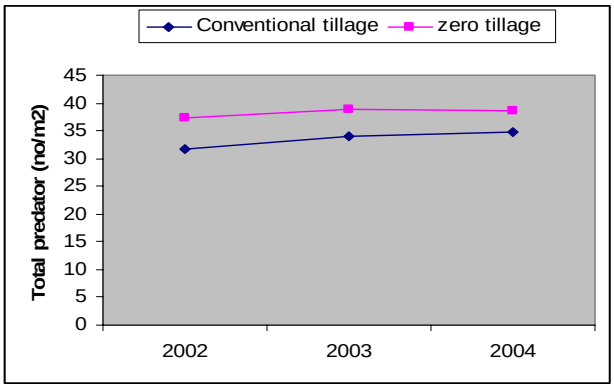
Fig 1. Dynamics of Predators' population in wheat under the tillage treatments: Variation in population of various species was noted in response to tillage treatments. Average population of spiders was 3.59 per m^2 in zero tillage and 1.36 in conventionally sown wheat fields (Table 1). The rove beetles (*Paedirus* spp) were 3.56 and 1.58 in zero tillage and conventionally sown wheat fields. The study suggested that the presence of rice stubbles helped to conserve predators of the rice



Bhalwal

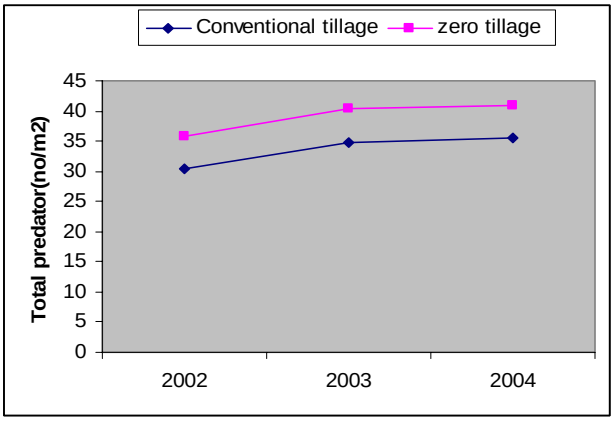
-wheat system. It is imperative to create biodiversity in agro-ecosystems that provides stability for conservation of the predators and minimizes pest outbreaks. A diverse ecosystem contains more buffers against environmental hazards by providing needed host, food, shelter and over wintering sites (Salim *et al*., 2003). Reduced biodiversity increases instability and increases chances of pest outbreaks.

Population and species variations in rice: The rice planted after harvesting zero-till wheat both at Muridke



Muridke

and Bhalwal sites had comparatively higher population of predators than the rice crop planted after conventional wheat (Fig. 2). Number of predators in zero-till wheat was 37.4, 38.8 and 38.6 per 20 sweeps during 2002, 2003, and 2004 respectively at Muridke (Fig. 2). At Bhalwal site, the predator population in rice crop planted after zero till wheat crop was 35.8, 40.5, and 41.0 during the same years (Fig. 2). Predators' population in rice planted in conventionally sown wheat also slightly increased at both the sites (Fig. 2). The magnitude of difference in the populations of predators between the zero-till and conventional tillage wheat crop was comparatively less in rice crop than in wheat crop (Fig. 1,



Bhalwal

Fig. 2. Dynamics of predators' population in rice after the tillage treatments applied to wheat: Variation in species of predators in response to tillage treatment was also noted in rice. At Muridke, the highest population 14.3 and 13.46 per 20 sweeps was of spiders in rice crop planted in zero-till and conventional wheat fields, that was followed by 13.8 and 12.0 per 20 sweeps of rove beetles (Paederus spp) in both types of fields (Table 2). The populations of remaining species were observed very low on rice crop in both wheat planting techniques. At the Bhalwal site, Araneae and rove beetles were found in significant number on rice crop planted after wheat in

both field types. These findings are in agreement with Atwal and Dhaliwal (2005) and Ramani (2003) who reported widespread and the most abundance of Staphylinidae *(Paederus fuscipes* Curts.) Coccinelidae and Araneae in rice fields.

Comparatively high population of predators in rice fields planted in zero-till wheat was due to comparatively high population in the adjoining fields, habitats or in the agricultural matrix as a whole.

Conclusion: The increase in the population of predators in rice fields due to zero-till sowing of wheat is of great importance to enhance activity of predators in suppressing population / infestation of insect pests in rice-wheat system. It is anticipated that any increase in the area under zero tillage will conserve the population of predators in the agricultural matrix and create biodiversity in the rice-wheat system.

Table 1. Population of predators in wheat after rice under the tillage treatments

Predators	2003		2004		2005		Average	
	Z*	C	Z	C	Z	C	Z	C
Muridke								
Spiders	2.95	1.32	3.12	1.22	4.70	1.55	3.59	1.36
Paedirus spp.	2.90	1.42	3.12	1.47	4.67	1.85	3.56	1.58
Coccinelids	0.87	0.55	1.22	0.57	1.77	0.86	1.28	0.66
Ophionea spp.	0.25	0.12	0.37	-	0.62	0.37	0.41	0.16
Total	6.97	3.41	7.83	3.26	11.76	4.63		
Bhalwal								
Spiders	3.02	1.40	3.40	1.70	4.62	1.67	3.68	1.59
Paedirus spp.	2.80	1.27	3.05	1.50	3.77	1.32	3.20	1.36
Coccinelids	0.5	0.37	0.72	0.37	1.27	0.57	0.83	0.43
Ophionea spp.	-	-	0.50	0.12	0.25	0.25	0.25	0.12
Total	6.32	3.04	7.67	3.69	9.91	3.81		

Z* = Zero tillage , C = Conventional

Table 2. Population of predators in rice after wheat under the tillage treatments

Predators	2002		2003		2004		Average	
	Z	C	Z	C	Z	C	Z	C
Muridke								
Coccinelids	2.80	1.90	1.0	0.5	1.0	0.8	1.6	1.06
Spiders	15.2	13.80	13.9	13.3	13.7	13.3	14.3	13.46
Conocephalus spp	2.0	1.50	2.2	1.7	2.1	1.7	2.1	1.63
Ophionea spp.	1.4	0.50	4.6	3.9	4.4	3.9	3.46	2.76
Agriocnemis spp.	3.0	2.50	3.1	2.5	2.9	2.5	3.0	2.50
Paedirus spp.	13.0	11.5	14.0	12.0	14.5	12.5	13.8	12.0
Total	37.4	31.7	38.8	33.9	38.6	34.7		
Bhalwal								
Coccinelids	2.0	1.5	1.0	0.8	1.5	0.5	1.5	0.93
Spiders	14.8	13.0	16.0	14.5	14.0	13.0	14.9	13.5
Conocephalus spp	2.5	1.5	3.0	2.0	2.0	1.5	2.5	1.66
Ophionea spp.	1.0	0.5	2.5	2.0	4.5	4.0	2.6	2.16
Agriocnemis spp.	2.5	2.0	3.0	2.5	3.5	2.5		2.33
Paedirus spp.	13.0	12.0	15.0	13.0	15.5	14.0	3.0	13.0
Total	35.8	30.5	40.5	34.8	41.0	35.5	14.5	

Z* = Zero tillage , C = Conventional

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