

## ORTHOPTERAN DIVERSITY IN IRRIGATED RICE ECOSYSTEM IN MADURAI, TAMIL NADU

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Biodiversity is the species richness in an ecosystem (Ehrlich & Ehrlich, 1981). It provides both opportunity and challenges how ecological communities are affected by human activity and environmental perturbations (Reaka-Kudla *et al.*, 1981). A total of three field trials were conducted during *kharif* and *rabi* 2000 and *kharif* 2001 at the wetlands of Agricultural College and Research Institute, Madurai, Tamil Nadu, to study the diversity and relative abundance of Orthoptera. Each treatment was replicated into two treatments namely protected (weeded) and unprotected (unweeded-10 weeds per square metre). Sampling was taken at weekly intervals. A total of seven to nine samplings in each season were taken.  $\alpha$ -Diversity (Whitaker, 1972) was used to calculate the similarity of taxa between protected and unprotected rice ecosystem. The values for  $C_j$  (Jaccard coefficient index) range from 0 (no similarity – species absent in weeded and unweeded ecosystem) to 1 (perfect similarity - species present in weeded and unweeded ecosystem). Data was plotted as percentage of similarity.

where,  $j$  is the number of taxa occurring in both samples A (weeded) and B (unweeded)

$a$  is the number of taxa in sample A (weeded) and  $b$  is the number of taxa in sample B (unweeded)

The present study revealed the occurrence of 21 species of grasshoppers and four species of crickets in the rice ecosystem (Table 1). Among the grasshoppers, 13, 13 and nine taxa, and 20, 20, and 19 taxa were present in protected and unprotected plots, respectively, during *kharif* and *rabi* 2000 and *kharif* 2001. All the four species of crickets were recorded in both the ecosystems. Among the short-horned grasshoppers, two species, *viz.*, *Oxya nittitula* (Walk.) and *O. fuscovittata* (Marsch.) were the common and dominant taxa in both the ecosystems. *Hieroglyphus banian* Fab. was the dominant taxon during *kharif* 2001 only.

The other taxa of short-horned grasshoppers *viz.*, *Acrida exaltata exaltata* (Walk.), *Gastrimargus africanus* Sauss., *Chrotogonus oxypterus* Blanch., *C. brachypterus* Bal., *Acrotylus humbertianus* Sauss., *Dioblocatantopus pinguis* (Stal.), *Catantopus ferrugineus* Bol. *Euprepocnemis alacris alacris* Serv., *Cyrtacanthacris tartarica* (Lin.), *Anacridium flavescens* (Fab.) and *Atractomorpha crenulata* (Fab.) (Acrididae: Orthoptera) were the rare species. Among the long-horned grasshoppers (Tettigoniidae), *Spheneroptera gracilis* Bur., *Conocephalus maculatus* (Le Guill.), *C. chinensis* (Redtenb) and *Holochlora albida* Brun., were the common species but *C. maculatus* was the dominant taxon in all the

Table 1. Diversity and relative abundance of Orthoptera in irrigated rice ecosystem.

Scientific name	Kharif 2000		Rabi 2000		Kharif 2001	
	Weeded*	Unweeded*	Weeded*	Unweeded*	Weeded*	Unweeded*
<b>Acrididae</b>						
<i>Acrida exaltata exaltata</i> (Walk.)	2	4	3	2	-	8
<i>Gastrimargus africanus</i> Sauss.	-	2	-	2	1	6
<i>Hieroglyphus banian</i> Fab.	-	-	-	-	8	2
<i>Oxya nittitula</i> Walk.	22	15	28	25	16	12
<i>O. fuscovittata</i> (Marsch.)	9	12	18	20	7	14
<i>Chrotogonus oxypterus</i> Blanch.	-	2	-	3	-	-
<i>C. brachypterus</i> Bal.	-	2	-	2	-	-
<i>Acrotylus humbertianus</i> Sauss.	-	1	-	1	-	4
<i>Ailopus thalassinus tamulus</i> Fab.	1	1	-	1	-	2
<i>Sphingonotus savigni</i> Sauss.	-	4	-	3	-	4
<i>Dioblocatantopus pinguis</i> (Stal.)	1	1	1	1	-	3
<i>Catantopus ferrugineus</i> Walk	1	1	1	2	-	4
<i>Euprepocnemis alacris alacris</i> Serv.	1	2	1	1	-	2
<i>Cyrtacanthacris tartarica</i> (Lin.)	1	5	2	12	2	8
<i>Anacridium flavescens</i> (Fab.)	-	2	-	2	-	3
<b>Pyrgomorphidae</b>						
<i>Atractomorpha crenulata</i> (Fab.)	2	6	2	8	2	4
<b>Tettigoniidae</b>						
<i>Spheneroptera gracilis</i> Bur.	4	2	6	3	2	6
<i>Euconocephalus incertus</i> (Walk.)	-	6	2	8	-	5
<i>Conocephalus maculatus</i> (Le Guill.)	8	12	16	11	10	8
<i>C. chinensis</i> (Redtenb.)	3	5	5	8	4	10
<i>Holochlora albida</i> Brun.	1	3	2	5	-	2
<b>Gryllidae</b>						
<i>Metioche vittaticollis</i> (Stal.)	8	5	6	4	10	6
<i>Telogyllus</i> sp.	3	6	2	7	2	8
<i>Modigryllus</i> sp.	2	4	1	4	2	2
<i>Gryllodes sigillatus</i> (Walk.)	4	5	3	2	4	5

\* Values in the columns are the total number of individuals collected in each season

**Table 2. Taxonomic similarity of Orthoptera between protected and unprotected rice ecosystem**

No.of Weeks	Short-horned grasshopper			Long-horned grasshopper				Crickets		
	Kharif 2000*	Rabi 2000*	Kharif 2001*	Kharif 2000*	Rabi 2000*	Kharif 2001*	Kharif 2000*	Rabi 2000*	Kharif 2001*	
I	0.70	0.80	0.88	1.00	1.00	1.00	0.66	1.00	0.00	
II	0.71	0.75	0.80	1.00	0.75	1.00	0.50	0.66	0.00	
III	0.70	0.60	0.60	0.90	0.66	0.90	0.50	0.66	1.00	
IV	0.33	0.50	0.56	0.50	0.55	0.45	0.50	0.33	1.00	
V	0.40	0.50	0.42	0.55	0.50	0.46	0.50	0.66	0.50	
VI	0.45	0.42	0.55	0.55	0.66	0.75	0.00	0.66	0.00	
VII	0.36	0.40	0.86	0.75	0.70	1.00	0.00	0.66	0.00	
VIII	0.63	0.57	-	0.80	0.75	-	0.00	0.50	-	
IX	0.92	0.80	-	0.90	1.00	-	0.00	0.00	-	

\* Values in the columns are indices

three seasons in both weeded and unweeded ecosystems and *Euconocephalus incertus* (Walk) was rare. Four species of crickets, namely, *Metioche vitaticollis* (Stal.), *Telogyllus* sp., *Modygryllus* sp., and *Gryllodes sigillatus* (Walk.) were common. Among them, *M. vitaticollis* was dominant and more abundant. A total of 18 species of weeds was recorded in the unweeded plots. Among the weeds, *Echinochloa calanum* (L.) Link., *E. crusgalli* (L.) Beauv., *Cyperus rotundus* L., *C. difformis* L., *C. iria* L., and *Fimbristylis miliaceae* (L.) were the dominant species.

The diversity index showed perfect similarity (1.00, 0.90, 1.00, 0.88) at the initial and maturity stage of crop (Table. 2). This indicated that common species (*O. nititula* & *O. fuscovittata*) had more individuals than rarer species, which had less number of individuals. This is in conformity with the statement of Capinera and Sechrist (1982). But, Hurd *et al.* (1971) stated that the abundance of one species is to have little effect on the other species in a stable ecosystem. A greater diversity of short-horned grasshoppers was recorded in fourth, fifth, sixth and seventh week sampling during *kharif* and *rabi* 2000 and *kharif* 2001. This is supported with the fact that host plant geographical distribution hypothesis predicts wide spread plant species (weeds) have a richer regional pool of insect and consequently usually have richer insect species (Ricklefs, 1987; Cornell & Lawton, 1992). Long-horned grasshoppers and crickets exhibited higher diversity in fourth and fifth week sampling. This was availability of plant species, alternate resources and favourable climates in unweeded plots as suggested by Shelton and Edward (1983). *H. albida* was a tourist grasshopper in the rice ecosystem. Moran and Southwood (1982) stated that tourist insects are non-predatory taxa with no known functional association with the rice except for shelter, sun basking and sexual display.

From the study, it was inferred that the diversity of orthoptera was less in weed and unweeded system after 10 days of transplantation. During the flowering stage of crops the diversity and relative abundance of grasshoppers were more in unweeded plots. The abundance of oligophagous grasshoppers was more in weeded plots than in unweeded plots. The polyphagous taxa of grasshoppers occurred only in unweeded plots (rice + weeds) and species richness and evenness were more in unweeded plots. Rare species with fewer individuals always occurred during the successional age of crop

in unweeded plots. During tillering and maturity stage of crop, grasshoppers showed greater similarity (less diversity).

It was concluded that the diversity of grasshoppers was less during tillering and maturity stages and was more during flowering stage in unweeded plots, because it has numerous species of grasses (resource concentration hypothesis). The diversity and relative abundance of grasshoppers were determined by species and stages of grasses in unweeded plots.

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