



Research Article

STUDY ON DIVERSITY OF ORTHOPTERA FAUNA IN SOUTH GUJARAT, INDIA

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ABSTRACT

In the present survey, a total 45 species belonging to 33 genera under 7 families were recorded. The family Acrididae was found to be the most dominant and was represented with 18 species, second dominant family was Tettigonidae and Gryllidae with 9 species. Pygromorphidae stood at third rank with 3 species and family Tetrigidae, Gryllotalpidae and Rhabdophoridae was represented by 2 species each. Family Tetrigidae and Rhabdophoridae were reported for the first time in Gujarat.

Key word: Orthoptera, Abundance, Diversity, South Gujarat.

INTRODUCTION

Orthoptera is one of the largest orders of grassland insects. The Orthopterans are distributed through the physiographic zones of the world but their distribution largely depends upon the vegetation like grasslands, forests and agricultural fields. Orthoptera have a significant importance in the economy of grassland ecosystems, being important primary herbivores (especially grasshoppers) and contributing to the diet of many other animals (birds, spiders, reptiles, etc.) (Gangwere *et al.*, 1997). They play a central role in food webs, as they are mostly primary herbivores and constitute an abundant food resource for the other groups such as lizards and raptors birds (Parr and Chown, 2003). Natural ecosystems of Gujarat range from wetlands, grasslands, agricultural areas, deciduous forests and deserts. Orthoptera are known to be a major component in grassland biodiversity (Weiss *et al.*, 2013; Weyer *et al.*, 2012) as well as in agricultural lands (Luoto *et al.*, 2000).

According to Gardenfors *et al.*, (2000) and Jonas *et al.* (2002) Orthopterans are especially interesting to study in relation to semi natural grasslands due to four reasons. First, the structure of Orthopteran communities is sensitive to environmental changes. Second, they are almost always present in grassland habitats. Third, they are easy to sample and there are not too many species to keep track of. Fourth, Orthopterans have a key role in grassland ecosystem because they constitute a large proportion of the arthropod biomass. Over 17,250 species are known to science throughout the world. More than 1,750 species, about 10%

of the total world species, have been recorded from India and nearly an equal number are yet to be discovered, 1033 species and 21 families have been recorded of Orthoptera from all over the states of India (ZSI, 1998). In Gujarat 18 Species Belonging to 5 Families were recorded by Pilo *et al.* (1996) from Shoolpaneshwar Wildlife Sanctuary, Parikh *et al.* (2001) recorded 4 families and 36 Species from GIR PA and Singh and Gandhi, (2012) have reported 4 families with 7 species from water reservoirs of Vadodara District. Despite the economic importance of grasshoppers, knowledge of basic aspects of the diversity of Orthoptera for Gujarat is limited or fragmentary. Hence, the aim of the present work is to make a preliminary survey on Abundance and Diversity of Orthoptera Fauna in South Gujarat, which is dominantly covered by the forest, grasslands as well as agricultural fields.

METHODOLOGY

Sampling of the orthoptera fauna was conducted from March 2014 to April 2015. Based on the agro-climatic zone south Gujarat District (Figure 1) is divided in to two zones i.e. South Gujarat heavy rainfall area, (Zone 1) this is a small but largely a tribal belt covering the districts of the Dangs, Navsari and Valsad. The area receives about 1800 mm of rains and the climate is semi arid dry sub humid; the soil is deep black, coastal alluvium. About 43% of the area is under forests and a similar proportion is cultivated. Irrigation is spread over about 24% of the cultivated area. Second zone is South Gujarat (Zone 2), covering the

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districts of Surat, Tapi, Bharuch and Narmada which has seen rapid industrial development in the recent decade. Over half of the land is cultivated and about a fifth of the cultivated area is irrigated. The area receives a little less than 1,000 mm of annual rainfall. The climate is semi-arid dry sub-humid and the soil is deep black coastal alluvium. The agricultural fields, grasslands and forested areas of these districts were selected as the sampling stations. All the sites were visited once in a month and the collected samples were pulled from each of the zone.

Sampling was done manually, where Orthopterans were directly collected by hand and transferred in plastic jars. Sampling was also done from the herb and shrub layers of the vegetation using a sweep net, nets were made of thick cotton cloth and had diameter of 30 cm at the mouth and beg length of 60 cm were used. The nocturnal katydids and crickets are collected by light trap method,

where halogen bulb was kept at the study site and the insect thus attracted were collected in the plastic container. The collected insects were transferred into jars that contained cotton soaked in ethyl acetate, and then transported to the laboratory where the insects were stretched and pinned using insect pins. The samples were then oven dried at 60°C for 72 hr to preserve them, after which they were set in wooden boxes and were identified using standard key for identification. Specimens thus identified in the laboratory were confirmed with the BNHS, Mumbai.

Data Analysis

Different diversity indices were calculated by making use of the software PAST 3.X such as Shannon diversity indices, Evenness indices as well as Marglef’s indices for richness. Analysis of variance was carried out with prism 6 Software.

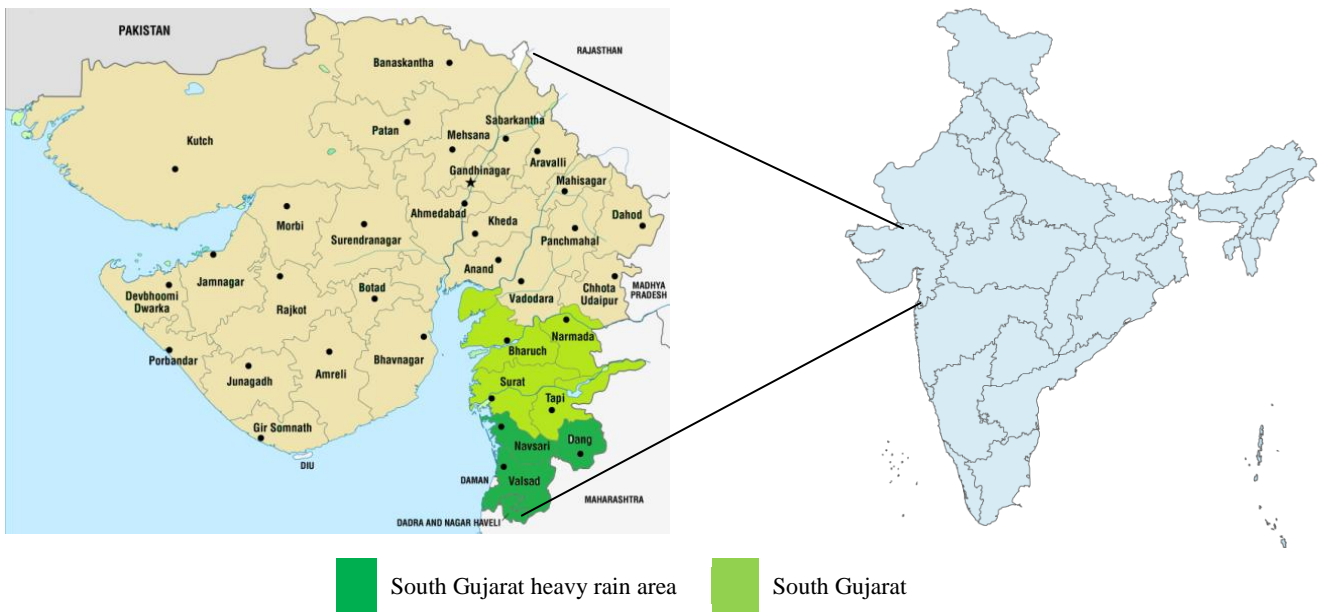


Figure 1. Map of Gujarat.

RESULT

A total 1650 orthopterans has been collected during the month from April, 2014 to April, 2015. Few representative of Orthoptera species are represented via pictures (Figure 2). Altogether 45 species of orthoptera belonging to 20 sub families under 7 families have been recorded according to their habitat (Table 1). According to the total number of species, dominant family is Acrididae (18 species), followed by Tettigonidae and Gryllidae (9 species), Pyrgomorphidae (3 species), Tetrigidae and Rhabdiphoridae (2 species). Of the total 7 identified families, 2 families are the ones which are reported for the first time in Gujarat viz., Tetrigidae and Rhabdiphoridae. Of all the families, Acrididae and was found to be present

in the entire three habitat i.e. forest, grasslands and agriculture fields. However, Pyrgomorphidae and Gryllotalpidae was found to be Grassland dominant; and Tetrigidae and Tettigoniidae was more commonly sighted in agricultural fields, and Gryllidae, Tettigoniidae and Rhabdiphoridae representatives were forest dominant. Family diversity (Shannon-wiener diversity index) and evenness (Pielous index) was highest for Acrididae followed by Tettigonidae and Gryllidae (Table 2). The species diversity of orthopterans calculated by using Shannon-Weiner diversity index was in the order, Acrididae (2.548) followed by Tettigonidae (1.837) and Gryllidae (1.684); which was followed by Pyrgomorphidae (0.939), Rhabdiphoridae (0.690) and Gryllotalpidae (0.688) the least was of Tetrigidae (0.362) (Table -2).



Oxya Sp.



Tetrix sp.



Calliptamus sp.



Gryllus domesticus



Gryllotalpa fossar



Camel Cricket



Hieroglyphus banian



Paracaedicia sp.



Poekilocerus pictus



Trilophidia sp.

Figure 2. Few representative of Orthoptera.

Table 1. Distribution of Orthoptera of South Gujarat in different habitats.

Family	Subfamily	Species Name	Forest	Grassland	Agriculture field	
Acrididae	Acridinae	<i>Acrida conica</i> (Fabricius, 1781)	+	-	+	
		<i>Acrida exaltata</i> (Walker, 1859)	-	+	+	
		<i>Acrida ungarica</i> (Herbst, 1786)	-	+	+	
			<i>Metaleptea brevicornis</i> (Johannson, 1763)	+	-	-
		Calliptaminae	<i>Calliptamus sp.</i>	+	+	-
		Catantopinae	<i>Xenocatantops humilis</i> (Bolivar, 1902)	-	+	+
		Cyrtacanthacridinae	<i>Schistocerca gregaria</i> (Forsk., 1775)	+	+	+
	<i>Schistocerca sp.</i>		+	+	+	
		Gomphocerinae	<i>Omecestus sp.</i>	-	-	+
	<i>Orphulella pelidna</i> (Burmeister, 1838)		+	+	-	
		Hemiacridinae	<i>Hieroglyphus banian</i> (Fabricius, 1798)	+	-	+
		Oedipodinae	<i>Acrotylus humbertianus</i>	-	-	+
	<i>Aiolopus thalassinus</i> (Fabricius, 1781)		-	+	+	
	<i>Gastrimargus sp.</i>		+	-	+	
	<i>Sphingonatus sp.</i>		+	-	-	
	<i>Trilophidia annulata</i> (Thunberg, 1815)		+	-	-	
		Oxyinae	<i>Oxya hyla hyla</i> (Serville, 1831)	+	+	-
	<i>Oxya hyla intricate</i> (Stal, 1861)		+	-	-	
	Tetrigidae	Tetriginae	<i>Tetrix arenosa</i> (Burmeister, 1838)	+	-	+
<i>Unidentified Sp</i>			-	-	+	
Pyrgomorphidae	Pyrgomorphinae	<i>Poekilocerus pictus</i> (Fabricius, 1775)	+	+	+	
		<i>Atractomorpha sp.</i>	-	+	+	
		<i>Chrotogonus sp.</i>	-	+	+	
Gryllidae	Gryllinae	<i>Gryllulus domesticus</i> (Linnaeus, 1758)	+	+	-	
		<i>Gryllodes sigillatus</i> (Walker, 1869)	+	+	+	
		<i>Gryllus bimaculatus</i> (De Geer, 1773)	+	-	-	
		<i>Gryllus sp.</i>	+	-	-	
		<i>Loxoblemmus doenitzi</i> (Stein, 1881)	+	+	-	
		<i>Loxoblemmus sp.</i>	-	+	-	
		<i>Prozvenella sp.</i>	-	+	-	
		<i>Teleogryllus oceanicus</i> (Le Guillou, 1841)	+	+	+	
		<i>Unidentified sp.</i>	-	+	-	
Gryllotalpidae	Gryllotalpinae	<i>Gryllotalpa fossor</i> (Scudder, 1869)	-	+	-	

		<i>Gryllotalpa africana</i> (Palisot de Beauvois, 1805)	-	+	-
Tettigoniidae	Phaneropterinae	<i>Paracaedicia sp. 1</i>	+	-	+
		<i>Paracaedicia sp. 2</i>	+	-	+
	Conocephalinae	<i>Neoconocephalus velox</i> (Rehn and Hebard, 1914)	+	+	+
	Gomphocerinae	<i>Euthystira brachyptera</i> (Ocskay, 1826)	-	+	+
	Listroscelidinae	<i>Hexacentrus sp</i>	+	+	-
	Phaneropterinae	<i>Amblycorypha rotundifolia</i> (Scudder, S.H., 1862)	+	-	-
		<i>Holochlora sp</i>	-	+	+
		<i>Scudderia furcata</i> (Brunner von Wattenwyl, 1878)	+	-	-
	Pseudophyllinae	<i>Sathrophyllia sp.</i>	+	-	-
Rhaphidophoridae	Ceuthophilinae	<i>Ceuthophilus sp.</i>	+	-	-
		<i>Unidentified sp.</i>	+	-	-

Table 2. Diversity indices of Orthoptera communities from two study sites.

S.No.	Family	Total number of subfamily	Total no. of species	Total no. of Individual	Pielou's Evenness	Shannon Wiener Diversity	Margalef richness
1	Acrididae	9	18	726	0.710	2.548	2.581
2	Tetrigidae	1	02	51	0.718	0.362	0.254
3	Pyrgomorphidae	1	03	183	0.853	0.939	0.384
4	Gryllidae	1	09	424	0.598	1.684	1.322
5	Gryllotalpidae	1	02	20	0.995	0.688	0.334
6	Tettigoniidae	5	09	233	0.698	1.837	1.468
7	Rhaphidophoridae	1	02	13	0.997	0.690	0.389

DISCUSSION

A Good diversity of Orthopteran species was recorded in south Gujarat. Their presence was more prevalent during monsoon and post-monsoon seasons, which concedes with the optimum growth of all type of vegetation. The quantitative concentration of the species varies from season to season and also from one region to other regions. From the present study we found that the family wise diversity, richness as well as the evenness was marginally higher in Zone 2 compared to Zone 1. Appreciable good assemblage of the Orthopterans is not a surprise as this area is dominated by grasslands as well as good number of agricultural fields. Orthoptera is one of the most important groups of herbivorous insect living in the grassland systems. Of all the families Acrididae was recorded to be most dominant in both the zones and were seen to the colonized in more diverse habitats such as grasses, agriculture fields as well as shrubs, however, of all the different habitats, grasses were found to be the most common habitats for grasshoppers. This observation are

parallel with the observation of Koli *et al.* (2010) and Waghmare *et al.* (2013) and Bhusnar *et al.*, (2015) in Maharashtra; Paulraj *et al.*, (2009) in Tamilnadu and Saha and Haldar (2009) in West Bengal. Next in order of dominant families were Tettigoniidae and Gryllidae which exhibited moderate diversity and richness in both the zones.

In the present study, 3 species belong to 3 genera have been recorded in family Pyrgomorphidae in South Gujarat Districts. Both the zone had the representatives of this family. Only 2 individuals of Gryllotalpidae were found in the study sites. This family commonly known as mole crickets is relatively common, but because they are active at night and spend nearly all their lives underground in extensive tunnel systems, probably they were less sighted. The Gryllotalpidae family displays extraordinary adaptations to the subterranean life-style such as compact cylindrical bodies, short appendices, reduced eyes and especially, forelegs transformed into efficient digging tools (Frank and Leppla 2008; Ingrisch and Rentz, 2009). Rhaphidophoridae, which includes the cave and camel

crickets are of little economic importance except as a nuisance in buildings and homes, especially basements which sometimes they invade if conditions resemble those of the natural caves they normally inhabit. Bidau (2014) have reported that the representatives of this family have wide but patchy distribution. The most noticeable finding is that this family is recorded for the first time in Gujarat state, and of the two collected representative only one identified till the genus level. During our work we reported Orthoptera belonging to Tetrigidae family with 2 species. Tetrigidae are variously called locust were found on the forest floor. Pushkar (2009) in their studies have reported that this group of orthopterans is having wide habitat preference and forest floor is also one of the preferred habitats.

The present study is work of one year which deals with the taxonomy, distribution and abundance of Orthoptera. This is the first report from Gujarat as no notable work has been done on this aspect, however, seasonal and long-standing studies will throw more light on the ecology and diversity of this group of Orthopterans. A long term study is needed to observe the species occurrence in all seasons and their interaction with the environmental changes, in order to get better and comprehensive information. However, this study will definitely give an addition to the existing knowledge of the entomologist of Gujarat and India as well.

CONCLUSION

This work concludes that South Gujarat is dominated by insects. The good number of the Orthopterans was not a surprised as this area is dominated by grasslands as well as good number of agricultural fields. The results which were being presented in this report might be the first comprehensive list of insects in the Gujarat. It is an obvious fact that insects contribute much to the ecological welfare and insect conservation has been recognized as vital for sustainable world in view of their critical role in conservation of ecosystem. However, this study will definitely give an addition to the existing knowledge of the entomologist of Gujarat and India as well. Hopefully, there will be a further research study on the insect biodiversity and taxonomy in this area, in order to get better and comprehensive information on those aspects to be documented for future reference.

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