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DIVERSITY OF SHORT HORNED GRASSHOPPER FAUNA IN THREE DIFFERENT ZONES OF TELANGANA, INDIA

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ABSTRACT

Survey conducted in three agricultural zones of Telangana *i.e.* Southern Telangana Zone, Northern Telangana Zone and Central Telangana Zone revealed, occurrence of total 21 species of short horned grasshoppers feeding on crops like, maize, cotton, rice, redgram, pearl millet, bajra, castor, safflower, sapota, okra, brinjal, shrubs and grass lands. There are about 17 genera belonging to the two families *i.e.* Acrididae and Pyrgomorphidae. Short horned grasshoppers assessed from these different zones revealed that Southern Telangana Zone has a higher species richness (R=3.764) followed by Northern Telangana zone (R=3.126) whereas Central Telangana Zone has the lowest species richness (R=2.405). Diversity was maximum in Southern Telangana Zone (D= 0.919, H=2.73) followed by Northern Telangana Zone (D= 0.9047, H= 2.578) whereas least diversity was recorded in Central Telangana Zone (D= 0.8628, H= 2.175).Highest evenness was observed in Southern Telangana Zone (0.896) followed by Northern Telangana Zone (0.891) whereas least observed in Central Telangana Zone (0.875). The family Acrididae was found to be the most abundant represented by 17 species followed by Pyrgomorphidae with 4 species. The subfamily Acridinae found to be the dominant among the other subfamilies. Among all the species, *Spathosternum prasiniferum prasiniferum* was more numerous than other.

Keywords **:** Abundance, Acrididae, Acridinae, Pyrgomorphidae, Short-horned grasshoppers.

Introduction

Among the class Insecta, the order, Orthoptera contributes about 26,730 valid species worldwide with 1,750 species of the total species being recorded in India (Tandon and Hazra, 1998). The suborder, Caelifera of the order, Orthoptera includes the short horned grasshopper showing maximum diversity with 8000 species, of which 36 species were under 28 genera (Chandra and Gupta, 2016). Grasshoppers are widely distributed in all the ecosystems with significant economic importance as they cause damage to all types of agricultural crops, grassland and forest ecosystems. Short horned Grasshoppers possess antennae with less than 30 segments along with saddle shaped pronotum and hind legs being used for jumping purpose.

Telangana has different agricultural zones like Northern Telangana Zone, Central Telangana Zone and Southern Telangana Zone with a variety of crop ecosystems including rice, cotton, maize, soybean, castor, jowar, groundnut and other pulse crops. Grasshoppers being phytophagous consume a wide variety of crop plants and cause damage. Kirby, 1914 has prepared a catalogue for the Acrididae members. Usmani *et al.* (2010) from western Uttar Pradesh made studies on the behaviour of grasshopper and significance of genital organs in taxonomic categorization of species of Indian Acridoidea exclusively Orthoptera (Usmani and Kumar, 2011). In India, Kumar and Usmani, 2012 from Punjab and Dhakad *et al.* (2014) from Udaipur have documented acridids and recorded the species richness of grasshoppers in different ecosystems.

In general, the spread of grasshoppers decreases as latitude increases, implying that their occurrence increases closer to the equator. Rather than being host-specific, these insects have polyphagous feeding habits. They are widely scattered over the world, but their habitats vary significantly (Nayeem, 2014), further a change in the habitat, result in an impact on biodiversity and species richness. Natural afforestation on abandoned land may result in a short-term increase in species richness, though it would result in a long-term decrease in species numbers, particularly for species that rely on open-land habitats (Steck *et al.,* 2007). Low grasshopper population affects food chain, while large grasshopper population cause rapid loss of vegetation, resulting in increased runoff, soil erosion, and elimination of food sources for many species (Bhusner, 2015).

It was the need of the hour to conduct a systematic survey for collection and classification of the acridid fauna of Telangana, keeping in view the economic relevance of grasshopper damage in agriculturally growing nation like India. An extensive survey of Telangana is required by visiting different agricultural areas in various Telangana Zones (Northern Telangana Zone, Southern Telangana Zone and Central Telangana Zone) in order to conduct a thorough investigation and present a comprehensive picture of Telangana's grasshopper fauna. The survey can lead to a large number of specimens, which serve as foundation for the current critical investigation. In order to provide intriguing findings on the distribution of grasshopper species in various zones of Telangana state as well to record their distribution and categorization.

Visualizing the recent development of incidence of grasshoppers causing huge damage to crops like maize and cotton in Telangana which caused farmers to carry management through insecticides without recording the level of incidence and damage. Lakhs of grasshoppers have invaded the fields and damaged maize crop in about 1,000 acres of land at Gambhipur, Govardhanagiri and Ghanapur villages in Toguta mandal, within a week, where the farmers in these villages have completely lost their crop (The Hindu, 2019) during September, 2019. This was reported later as a new species *Heiroglyphus nigrorepletus* (Bolivar) infesting maize in Telangana by Nagaraju (2021) which caused much loss to the crop. Hence there is a need for documentation of grasshopper fauna. As there is no such type of published data or research work made to document the grasshopper fauna in Telangana, an attempt was made to study taxonomy of Acrididae so that if any grasshopper incidence and damage will occur, there will be ready information to take up timely management. Keeping in view of the recent incidence of grasshopper, an attempt was made to document the short horned grasshopper fauna in Telangana

Materials and Methods

An intensive survey was conducted in three ecosystems *viz.,* South Telangana Zone, North Telangana Zone, Central Telangana Zone. Short horned grasshoppers were captured with a net by sweeping the crop fields, abandoned fields and grass bunds for two hours in predetermined area in the particular locality once in a month in each ecosystem from October (2020) to May (2021). Later they were killed in killing bottles having ethyl acetate treated cotton balls. Grasshoppers were dried, mounted and labeled (Place of collection, Date of collection, Host plant, Name of collector and Habitat). The following diversity indices were worked out for each zone.

Species richness (S) = number of species / genera collected.

Species diversity (H'): $(H') = -\sum^{k} p_i \ln p_i$

Simpson index of diversity (1-D):

$$D = \sum_{n=1}^{\infty} \left(\frac{N(n-1)}{N(N-1)} \right)$$

Shannon-wiener index (H): ${}^{S}H^{1} = -\sum p_i \log_e p_i$

Pielou's evenness index or equitability (E): $E = H^{'}/\ln (S)$

Statistical analysis: Simpson index of diversity (1-D), Shannon-wiener index (H) and Pielou's evenness index or equitability (E) were computed by using the software; PAST (Paleontological Statistics Tool) version 4.03. The relative abundance was calculated by the following formula.

Relative abundance (%) = $n_i \times 100/N$

Results and Discussion

Diversity of short horned grasshoppers in three different zones of Telangana was compared to understand distribution of grasshopper fauna in different zones, where significant was observed in the species diversity. However, under the order, Orthoptera, the family, Acrididae (17) was more diverse than the Pyrgomorphidae (4) (Table 1).

In Acridinae, *Acrida exaltata* (Walker), *Acrida turrita* (Linnaeus), *Phlaeoba infumata* (Bolivar), under the subfamily, Catantopinae, *Xenocatantops karnyi* (Kirby), *Diabolocatantops pinguis* (Stol), from the subfamily, Cyrtacanthacridinae, the species, *Crytacanthacris tatarica tatarica* (Linnaeus), in

Hemiacridinae, *Hieroglyphus banian* (Fabricus), *Hieroglyphus nigrorepletus* (Bolivar), under the subfamily, Oediopodinae, *Aiolopus thalassinus thalassinus* (Fabricus), *Gastrimargus africanus africanus* (Saussure), from the subfamily, Oxyinae, *Oxya hyla hyla* (Serville) and from the subfamily, Spathosterninae, *Spathosternum prasiniferum prasiniferum* (Walker) were recorded from all the three zones of Telangana.

Under the subfamily, Calliptaminae, *Acorypha glaucopsis* (Walker) and *Eyprepocnemis alacris alacris* (Serville), *Catailopus indicus* (Uvarov) belonging to the sub family (Eyprepocnemidinae) were encountered only from Southern Telangana Zone.

Four species were recorded from Pyrgomorphidae among these *Atractomorpha crenulata crenulata* (Fabricius), *Chrotgonus trachypterous trachypterous* (Blanchard), *Neorthacris acuticeps acuticeps* (Bolívar), *Poekilocerus pictus* (Fabricius), under the subfamily, Oedipodinae, *Acrotylus humbertianus* (Saussure) and from the subfamily, oxyinae, *Oxya nitidula* (Walker) were not encountered from Central Telangana Zone.

Present investigation on estimation of diversity indices for grasshoppers recorded from three zones of Telangana revealed that diversity was maximum. Diversity was maximum in Southern Telangana Zone (D= 0.919, H=2.73) followed by Northern Telangana Zone (D= 0.904, H= 2.578) whereas least diversity was recorded in Central Telangana Zone (D= 0.862, H= 2.175) (Table 4.24). The high diversity in Southern Telangana Zone might be due to diverse vegetation in the college farm and biodiversity park, Rajendranagar because that grasshopper used to move on crops for their nutrients requirement. This is acceptable with the results that grasses have less nutrients compared to other crops (Tscharntke and Greiler, 1995). Hence grasshopper use to feed on other crops for their nutritional requirement (Behmer and Joern, 1993).

Table 1 : Diversity indices of three zones of Telangana

S. No	Zones	Margalef'S species Richness	Simpson-1-D	Shannon – H	Pielou's Eveness Index
1.	Northern Telangana Zone	3.126	0.904	2.578	0.891
2.	Southern Telangana Zone	3.764	0.919	2.73	0.896
3.	Central Telangana Zone	2.405	0.862	2.175	0.875

Margalef's Species Richness is a measure of different taxa or species present in a community. Out of the three zones reported in the present study, Southern Telangana Zone (R = 3.764) was found to be the highest species rich zone followed by Northern Telangana Zone (R= 3.126) whereas Central Telangana Zone (R=2.405) was found to have the least species richness (Table 1).

Pielou's Eveness Index (e) indicates the degree of distribution of individuals in the various taxa of a community. Higher the value of index, more even is the distribution of individuals among the present taxa. Highest eveness was observed in Southern Telangana Zone (0.896) followed by Northern Telangana Zone (0.891) whereas least observed in Central Telangana zone (0.875) (Table 1).

The survey yielded 531 specimens in total representing 11 subfamilies, 17 genera and 21 species. It represents the first systematic collection of shorthorned grasshoppers from the area. The data showed that the family, Acrididae (85.47%) is more dominant than the family, Pyrgomorphidae (14.53%) (Figure 4.1). Similar results were reported by Kariuki *et al*. (2019) who found that the family, Acrididae was more abundant than the family Prygomorphidae. Other studies also reported the family Acrididae being the most dominant and distributed (Thakkar *et al*., 2015; Arya *et al*., 2015). The collected specimens represented the subfamily, Acridinae were more abundant of among all the other subfamilies from all the three zones of Telangana which was similarly with the results reported by Hussain *et al*. (2017) and least abundance was shown by the subfamilies, Calliptaminae followed by Eyprepocnemidinae (Figure 4.2, 4.3, 4.4, 4.5.).

S. prasiniferum prasiniferum was found to be the most abundant species among 21 species collected from Telangana, identical with the results reported by Raghavender and Vastrad (2017).

Table 2 : Diversity of short horned grasshoppers in three different zones of Telangana.

S. No.	Family / Sub family	Species	Name of the Zone		
			North Telangana Zone	South Telangana Zone	Central Telangana Zone
1.	Pyrgomorphidae	*Atractromorpha crenulata crenulata* (*Fabricius*)	+	+	+
2.		*Chrotogonus trachypterus* (Blanchard)	+	+	-
3.		*Neorthacris acuticeps acuticeps* (Bolivar)	+	+	-
4.		*Poikilocerus pictus* (Fabricius)	+	+	-
		Total	**4**	**4**	**1**
	Sub families of Acrididae				
5.	Acridinae	*Acrida exaltata* (Walker)	+	+	+
6.		*Acrida turrita* (Linnaeus)	+	+	+
7.		*Phlaeoba infumata* Bolivar	+	+	-
		Total	**3**	**3**	**2**
8.	Catantopinae	*Diabolocatantops pinguis* (Stol)	+	+	+
9.		*Xenocatantops karnyi* (Kirby)	+	+	+
		Total	**2**	**2**	**2**
10.	**Calliptaminae**	*Acorypha glaucopsis* (Walker)	-	+	-
		Total	**0**	**1**	**0**
11.	Cyrtacanthacridinae	*Cyrtacanthacris tatarica* (Linnaeus)	+	+	+
		Total	**1**	**1**	**1**
12.	Eyprepocnemidinae	*Cataloipus indicus* Uvarov	-	+	-
13.		*Eyprepocnemis alacris alacris* (Serville)	-	+	-
		Total	**0**	**2**	**0**
14.	Hemiacridinae	*Hieroglyphus banian* (Fabricius)	+	+	+
15.		*Hieroglyphus nigrorepletus* (Bolivar)	+	+	+
		Total	**2**	**2**	**2**
16.	Oediopodinae	*Aiolopus thalassinus* (Fabricius)	+	+	+
17.		*Acrotylus humbertianus* (Saussure)	+	+	-
18.		*Gastrimargas africanas africanas* (Saussure)	+	+	+
		Total	**3**	**3**	**2**
19.	**Oxyinae**	*Oxya hyla hyla* (Serville)	+	+	+
20.		*Oxya nitidula* (Walker)	+	+	-
		Total	2	**2**	**1**
21.	Spathosterninae	*Spathosternum prasiniferum prasiniferum* (Walker)	+	+	+
		Total	**1**	**1**	**1**
		Total of Acrididae	**14**	**16**	**11**
		Grand total (Acrididae + Pyrgomorphidae)	**18**	**20**	**12**

Total number of species present in Acrididae - 17 and Pyrgomorphidae - 4 among all three zones, + Present, - Absent.

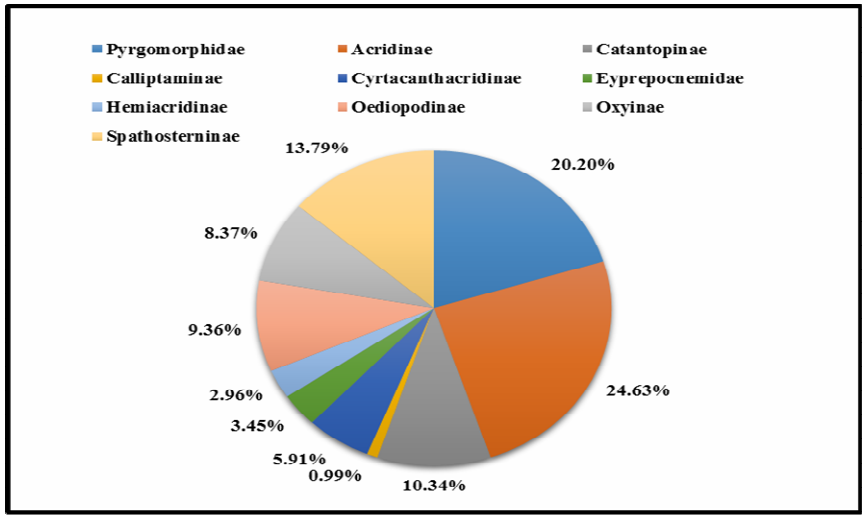

Fig. 1 : Relative abundance in Southern Telangana Zone

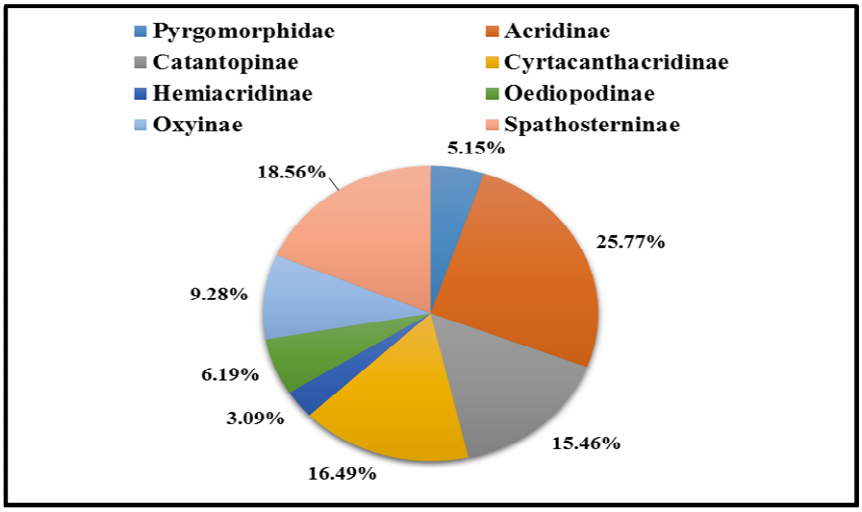

Fig. 2 : Relative abundance in Central Telangana Zone

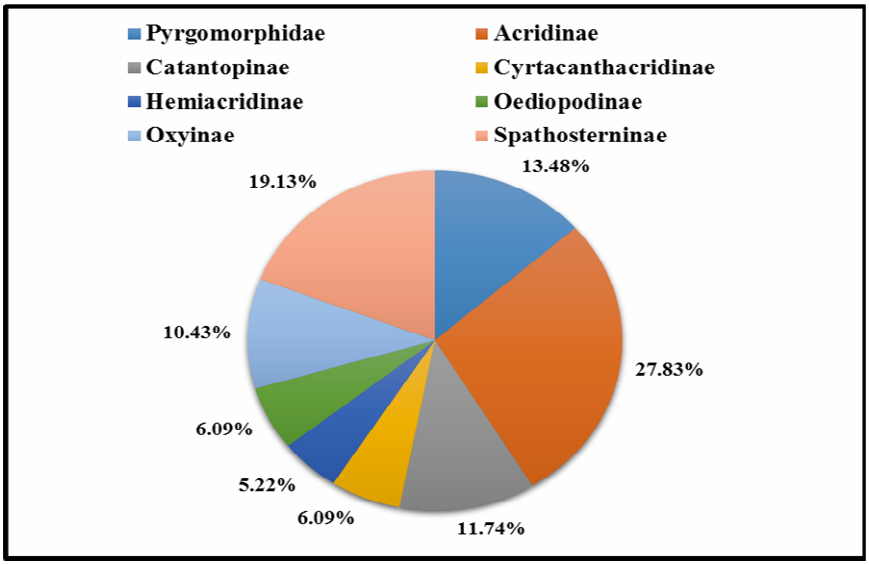

Fig. 3 : Relative abundance in Northern Telangana Zone

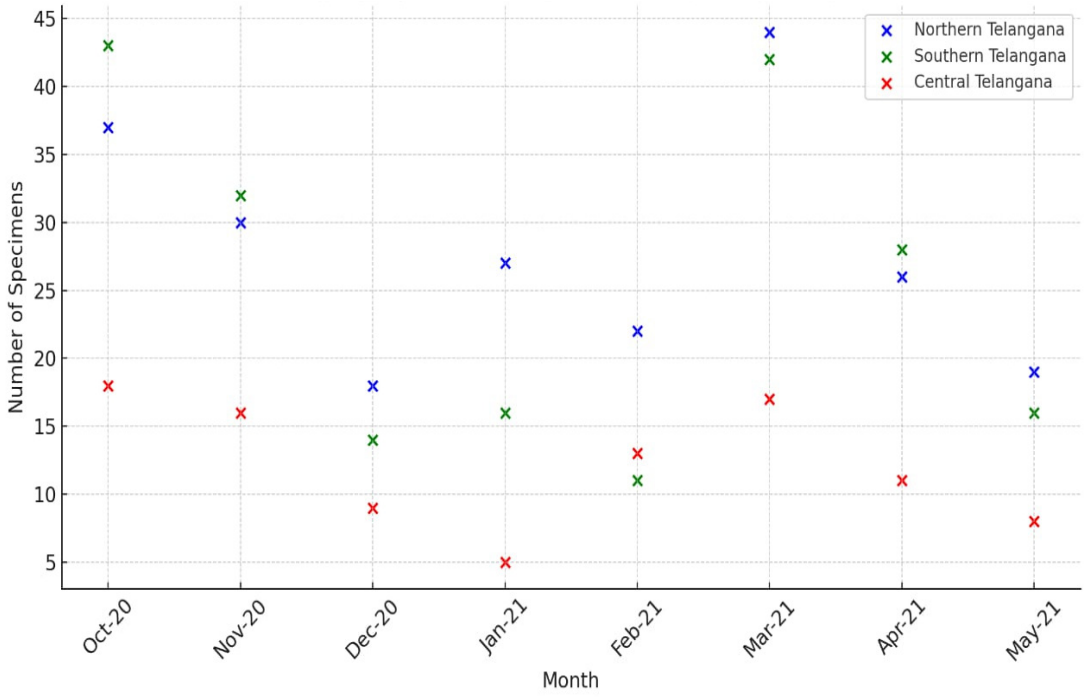

Fig. 4 : Zone wise absolute species abundance

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