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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 14 (8): 507-510, 2011
ISSN 1028-8880 / DOI: 10.3923/pjbs.2011.507.510

Species Composition of Grasshoppers (*Orthoptera*) in open Plots and Farmlands in Calabar Metropolis, Southern Nigeria

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Abstract: The grasshoppers are strategic in the welfare of man and may constitute a major threat when its population is not checked. A study on the distribution of grasshoppers in open plots and farmlands was carried out within Calabar Metropolis between August to November, 2010. A total of 295 grasshoppers belonging to 11 species grouped under 3 families (Tettigoniidae, Acrididae and Pyrgomorphidae) were collected from 8 study locations. Grasshoppers were collected weekly from all study sites using sweep nets between 11 a.m .to 4 p.m. The collection was done using sweep nets between 11 a.m. to 4 p.m. when grasshoppers baked themselves under the sun. The percentage abundance of these species were *Spathosterrium pygmaeum* (16.27%), *Tettigonia viridissima* (11.86%), *Catantops spissus* (11.19%) *Acridaturita* sp. (10.17%), *Gastrimargus acrididae* (9.83%), *Schistocerca nitens* (9.49%), *Tylopsis* sp. (7.46%), *Zonocerus variegatus* (6.78%), *Omocestus viridulus* (6.10%), *Scudderia mexicana* (5.76%) and *Zonocerus elegans* (5.08%). *Tettigonia viridissima* and *Acridaturita* sp. were largely distributed as it occurred in 7 of 8 study sites while *Scudderia mexicana* was the least distributed, as it was reported in 3 sites only. The dominant grasshopper species in open plot was *Spathosterrium pygmaeum* (19%) in relative abundance and the least was *Zonocerus variegatus* (0.64%). *Zonocerus variegatus* was the dominant species in farmland (14%) in relative abundance and the least was *Schistocerca nitens* (4%). Chi-square test showed a high significant difference between the distribution of grasshoppers in open plots and farmlands ($p<0.05$). Variations in grasshopper species composition were attributed to lizard predation and management practices such as grass cutting, fertilizer and pesticide applications. It was therefore concluded that species abundance and population of grasshoppers could be enhanced by minimizing human activities that interfere with land use.

Key words: Grasshoppers, orthoptera, habitat, species abundance, open plots, farmlands

INTRODUCTION

The terrestrial habitats are rich in terms of their insect fauna and floristic composition. At present, our knowledge of the vast majority of the insects in the Nigerian terrestrial ecosystems is far from being complete (Ewuim, 2004). New areas of vegetation are being cleared for farming and urban development and therefore the environment is continuously changing (Ewuim, 2004). Calabar metropolis is a growing city with several undeveloped plots of lands which have been converted for agricultural purposes and others with uncompleted structures. Different insects inhabit these converted plots and vegetation among which are the grasshoppers.

Grasshoppers are insect pests of field crops with biting and chewing mouthparts, they belong to the order Orthoptera (Emosairue, 2007). Some species are specialized on rangeland and have mandibles for slicing grass foliage while others often have mixed diets of grasses and leafy crops and possesses mandibles with molar-like grinding surfaces (O'Neil, 2002). They have been described as significant and requiring control in western North America rangelands (Demirel and Cranshaw, 2006) where's its conservation has been suggested as insects are bioindicators of Changes in environmental conditions (Riedel *et al*., 2008).

Some grasshopper activity such as feeding on weeds and weed seeds is actually beneficial example *Hesperotettix viridis*, which feed exclusively on snakeweed. This scavenging activity is important in trash burning which purify the environment (O'Neil, 2002). In controlling the damage potential caused by some species; it is needful to understand their identities and the densities of the species composing infestation in an area so as to assess accurately the economic threat and select reasonable solution (Pfadt, 2002).

DeBrey *et al.* (1993) estimated that grasshoppers consume up to 25% of the available forage in the West African countries annually. When grasshoppers' management is not attempted in areas of grasshopper outbreaks, all available forage can be consumed. They also indicated that grass hoppers are voracious feeders,

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consuming approximately one half of their body weight in green forage per day.

Over 50% of the cassava crop (*Manihot* sp.) is estimated to be lost in years of high *Zonocerus variegatus* abundance in Southern Nigeria (Baker *et al*., 1977). As early as 1970 the outbreak of *Zonocerus variegatus* in Nigeria were becoming so large and frequent that the National Agricultural Technical Committee declared it a major pest (Chapman and Page, 1978). This led to a joint research programme by the Centre for Overseas Pest Research, London (now part of the Natural Resources Institute) and the University of Ibadan, Nigeria from 1973 to 1976. Grasshoppers have been reported as pest of spices, *Ocimum* species in Southwester Nigeria (Banjo *et al*., 2006).

This study was conducted to determine the diversity, distribution and abundance of grasshoppers in open and cultivated plots Calabar Metropolis with a view to asses their population against possible outbreak.

MATERIALS AND METHODS

This study was carried out in 8 locations which included: Unical Farm (UF); Unical Open Plot (UOP); Anantigha Farm (AF); Anantigha Open Plot (AOP); Margaret Ekpo international airport Farm (MEF); Margaret Ekpo international airport Open Plot (MEOP); Calabar Municipal council Farm (CMF); and Calabar Municipal council Open Plot (CMOP).

The study sites were selected within Calabar South and Calabar Municipality. Subsistence farming was the major practice in all the farm sites. The major crops cultivated were: *Talinum triangulare* (waterleaf), *Telfairia occidentalis* (fluted pumpkin), *Zea mays* (maize), *Abelmoschus esculentus* (okra), *Spinacea oleracea* (spinach), *Solanum melongena* (garden egg) and *Manihot esculenta* (cassava).

Grasshoppers were collected weekly from all study sites for 4 months (August to November, 2010). The collection was done using sweep nets between 11 a.m. to 4 p.m. when grasshoppers baked themselves under the sun. Samples collected were placed in killing jars, labelled appropriately and transported to the Department of Zoology and Environmental Biology laboratory for sorting. Samples were identified using keys of Medler (1980)-Insects of Nigeria. Voucher specimens were kept for reference purposes.

Statistical analysis: The data obtained were subjected to a chi-square (χ^2) analysis to determine the difference in species abundance in the various study sites.

RESULTS AND DISCUSSION

The result of the study revealed that grasshoppers collected in the areas varied according to management practices such as grass cutting, fertilizer and pesticide applications. Eleven grasshopper species were collected and reported in Table 1. These were: *Tettigonia viridissima, Scudderia mexicana, Tylopsis* sp., *Gastrimargus acrididae, Acridaturita* sp., *Catantops spissus, Spathosterrium pygmaeum, Schistocerca nitens, Omocestus viridulus, Zonocerus elegans* and *Zonocerus variegatus*. Of these, *Tettigonia viridissima* and *Acridaturita* sp. were more largely distributed and occurred in 7 of 8 study sites while *Scudderia mexicana* had least distribution, as it was reported in 3 sites only. *Spathosterrium pygmaeum* recorded the highest relative abundance, 16.27% followed by *Tettigonia viridissima* 11.86%, *Catantops spissus* 11.19%, *Acridaturita* sp. 10.17%, *Gastrimargus acrididae* 9.83%, *Schistocerca nitens* 9.49%, *Tylopsis* sp. 7.46%, *Zonocerus variegatus* 6.78%, *Omocestus viridulus* 6.10%, *Scudderia mexicana* 5.76% and *Zonocerus elegans* 5.05% (Table 1).

The grasshopper species in open plot and their relative abundance in the total sample were: *Spathosterrium pygmaeum* 19%, *Catantops spissus* 17%, *Schistocerca nitens* 14%, *Acridaturita* sp. 13%, *Gastrimargus acrididae* 12%, *Tettigonia viridissima* 11%, *Tylopsis* sp. 9%, *Omocestus viridulus* 3%, *Zonocerus elegans* 1% and *Zonocerus variegatus* 0.64% (Table 2). While the dominant species in farmland were: *Zonocerus variegatus* 14%, Tettigonia viridissima and *Spathosterrium pygmaeum* 13%, *Scudderia mexican* 12%, *Omocestus viridulus* and *Zonocerus elegans* 9%, *Gastrimargus acrididae* 7%, *Acridaturita* sp. 7%, *Tylopsis* sp. 6%, *Catantops spissus* 5% and *Schistocerca nitens* 4% (Table 2).

The population of grasshoppers was higher in relative abundance in open fallow plots than cultivated areas. Some portions of the Unical farm are deliberately left fallow to improve the soil fertility so it could be used as practical and demonstration farms by students. The Margaret Ekpo environment is highly restrictive due to its proximity to the Calabar international airport. These plots had fallowed and were characterised by minimal human disturbances and over grown weeds which may have attracted higher number of grasshoppers. This is in agreement with the studies of Van Wingerden *et al*. (1992) and Capinera and Sechrist (1982) report that fertilizing and grazing areas such as pastures affected grasshopper populations. It is likely that these anthropogenic activities deprive grasshoppers of their host plant which may

Table 1: Distribution and Relative abundance of grasshopper species in the different study areas

		Locations								
Family	Species	UF	UOP	AF	AOP	MEF	MEOP	CMF	CMOP	Collected No. (%)
Tettigonidae	*Tettigonia viridissima*	8	4	-	4	3	5	7	4	35 (11.86)
	Scudderia mexicana	9	-	3	-	5	-	-	-	17 (5.76)
	Tylopsis sp.	-	-	-	-	2	10	6	4	22 (7.46)
Acrididae	*Gastrimargus acrididae*	2	4	-	-	8	12	-	3	29 (9.83)
	Acridaturita sp.	3	5	4	8	2	4	-	4	30 (10.17)
	Catantops spissus	3	7	4	5	-	5	-	9	33 (11.19)
	Spathosterrium pygmaeum	4	15	5	9	-	-	9	6	48 (16.27)
	Schistocerca niteus	6	8	-	7	-	4	-	3	28 (9.49)
	Omocestus viridulus	3	-	6	-	-	5	4	-	18 (6.10)
Pyrgomorphidae	*Zonocerus elegans*	1	-	5	2	4	-	3	-	15 (5.05)
	Zonocerus variegatus	8	-	4	-	2	-	5	1	20 (6.78)
Total		47	43	31	35	26	45	34	34	295 (99.99)

Table 2: Distribution between open plot and farmland

Species	Open plot	Farmland
Tettigonia viridissima	17 (10.08)	18 (13.04)
Scudderia mexicana	0 (0)	17 (12.32)
Tylopsis sp.	14 (8.92)	8 (5.8)
Gastrimargus acrididae	19 (12.1)	10 (7.25)
Acridaturita sp.	21 (13.38)	9 (6.5)
Catantops spissus	26 (16.56)	7 (5.07)
Spathosterrium pygmaeum	30 (19.11)	18 (13.04)
Schistocerca niteus	22 (14.0)	6 (4.35)
Omocestus viridulus	5 (3.18)	13 (9.42)
Zonocerus elegans	2 (1.27)	13 (9.42)
Zonocerus variegatus	1 (0.64)	19 (13.77)
Total	157	138

$\chi^2_{cal} = 76.187$, $\chi^2_{tab} = 18.30$, $p<0.05$

encourage their migration to undisturbed areas in search of alternative food source. The work of Capinera *et al.* (1997) reported high densities of grasshoppers in weedy areas than in grass pastures with grasshopper abundance showing a skewed population distribution. Earlier Olfert *et al.* (1994), Bird and Romanow (1966) and Davis (1949) had observed that weedy roadside harbours more grasshoppers, including crop feeding species than bare land. These authors assessed that planting roadsides and farm margins with grass or eliminating weeds from such areas, reduced the number of grasshoppers in crop field. The Anantigha area had high level of agricultural activities however farmers preferred monocropping of waterleaf or pumpkin leaf which were not attracted to grasshoppers. This explains the reason for the lower number of grasshoppers collected when compared to other farm locations.

The low relative abundance of some grasshopper species may be due to predation by lizard as they were observed feeding on grasshoppers during the sample collection. The report of Capinera *et al.* (1997), suggested that avian predation might account for the disappearance of grasshoppers before they achieved the adult stages.

A result of the chi-square (χ^2) test analysis showed that the distribution of grasshoppers in open plots and farmlands is highly significant ($p<0.05$).

The present study also showed that all the species sampled occurred in more than 3 locations which indicated that they are cosmopolitan in distribution. This is in consonant with the study of O'Neil (2002) that most species occur in both low and high elevations in meadows, shrub lands, irrigated and dry land crops, fencerows, roadsides and pastureland. Also, grasshoppers formed the second highest group of insects collected on different heights in Malaysia (Idris *et al.*, 2002).

CONCLUSION

It can therefore be concluded that species abundance and population of grasshoppers could be determined or influenced by certain human activities that disturb or modify the environment. It is capable of being a good candidate for detecting short term changes in the environment. This should form a baseline information for the agencies involved in land use and agriculture in Calabar, Nigeria.

ACKNOWLEDGMENTS

We thank the Department of Zoology and Environmental Biology, University of Calabar for granting us the use of their laboratory in classification. Also Inemesit Etuk Umo and Akpan who helped us during the collection of grasshoppers.

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