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Incidence of orthopteran species (Insecta: Orthoptera) among different sampling sites within Satoyama area, Japan

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Abstract: In a survey of the orthopteran assemblages in four different sampling sites in Satoyama area, fifty different species have been recorded. These species belong to 10 families, 17 subfamilies and 27 tribes. Family Acrididae was found to exhibit the highest number of subfamilies and tribes (four subfamilies and eight tribes). This was followed by Tettigoniida with six tribes. However, both of Gryllidae and Tettigoniida harbored the highest number of observed species (12 species). On the other hand, three families were considered comparatively poor families exhibiting a single subfamily, a single tribe and a single species. These families were Eneopteridae, Mecopodidae and Pyrgomorphidae.

Keywords: Distribution, incidence, Orthoptera, presence-absence, Satoyama.

Orthoptera are one of the largest and most diverse groups of insects. They are functionally important, being the dominant aboveground invertebrates in pastures and natural grasslands when judged by biomass (Scott et al. 1979; Risser et al. 1981). Some orthopteran species, in particular acridids, cause significant damage to tree seedlings (Joshi et al. 1999) and agricultural crops. They are also important components of the food chain for many birds and mammals (Capinera et al. 1997; Mayya et al. 2005), and hence resource management practices that alter orthopteran population dynamics will affect several trophic levels in the food chain (Capinera et al. 1997). In recent years man-made impacts have altered cropping patterns and agronomical practices due to urbanization, labour problems and a desire for greater profits. The changing scenario in agriculture is affecting primary consumers and thereby creating impacts for entire food webs, thus it is necessary to study the distribution and incidence of orthopteran species as primary consumers in relation to their habitats.

In this study, 50 different orthopetran species representing 10 families, 17 subfamilies and 27 tribes have been tabulated during a survey of their assemblages from different habitats of Satoyama area.

Material and Methods

Study Area

The survey of orthopteran assemblage was conducted in four sampling sites (Kitadan Valley - 36.5457N & 136.694E; Zontan area - 36.560N & 136.682E; Kakuma Campus grassland - 36.546N & 136.708E; Kanazawa Castle Park: - 36.561N & 136.656E) within Satoyama area of Kanazawa City, Ishiakawa Prefecture, Japan. Kanazawa is located on

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the area facing Japan Sea, boarded by the Japan Alps, Hakusan National park and Noto Peninsula National Park. The city sits between the Sai and Asano rivers covering an area of ca. 467.77km^2. Satoyama covers an area of ca. 74ha and is located at 150m altitude, 5km southeast from the city center. The area comprises various habitat types ranging from secondary forests dominated by Konara *Quercus serrata*, Abemaki *Q. variabilis*, Moso Bamboo *Phyllostachys pubescens*, and Japanese Cedar *Cryptomeria japonica*.

Sampling protocol

The entomological sweep net was used for sampling orthopteran species from various habitats to cover a sampling period extending from May till September for two consecutive years, 2008 and 2009. Sampling was achieved in 1000 to 1400 hr once in a month. Collected specimens were immediately preserved in 70% ethanol. They were later identified, counted, sorted and kept in individual labeled glass vials in the laboratory. These vials could be stored in freezer for a year with no apparent damage to the specimens (Mulkern & Anderson 1959; Brusven & Mulkern 1960; ElSayed 2003; ElSayed & ElShazly 2006).

Identification

Orthopteran species were identified following the taxonomic key of Ichikawa et al. (2006). Specimens were also compared with identified museum specimens in Kanazawa University for further confirmation.

Meteorological variables

The weather of Kanazawa is temperate, though rainy. Average temperature were 4^{0}C in January, 15^{0}C in April, 25^{0}C in July and August, 15^{0}C in October, and around 5^{0}C in December. The average minimum record was -2.3^{0}C (2007); on the other hand, the average maximum temperature was 37.5^{0}C (2007). The city is relatively wet with an average relative humidity of 73% and an average of 178 rainy days a year. Precipitation is relatively the highest in autumn and winter with an average rainfall of more than 250mm from November through January.

Average temperature, relative humidity and precipitation data of 2008 and 2009 were obtained from Japan Meteorological Office (http://www.data.kishou.go.jp) and compared with data collected from the study sites for further confirmation.

Table 1. Number of families, subfamilies, tribes and species of orthopteran species co-occurring in four sampling sites within Satoyama area.

Family	Number		
	Subfamilies	Tribes	Recorded species
Acrididae	4	8	8
Eneopteridae	1	1	1
Gryllidae	2	3	12
Mecopodidae	1	1	1
Phaneropteridae	1	2	3
Pyrgomorphidae	1	1	1
Mantidae	1	1	2
Tetrigidae	2	2	7
Tettigoniidae	2	6	12
Trigonididae	2	2	3
Total	17	27	50

Results

A total of 50 orthopteran species were collected during the study period from the four sampling sites within Satoyama area (Table 1). Collected orthopteran species were belonging to 10 families representing 17 subfamilies and 27 tribes (Table 1). Comparatively, the highest number of species was confined to Gryllidae and Tettigoniidae (12 species). This was followed by family Acrididae (8 species). However, family Acrididae was found to harbor, comparatively, the highest number of subfamilies and tribes (four subfamilies and eight tribes) as indicated in Table 1. The least number of species (one) was found in three families: Eneopteridae, Mecopodidae and Phaneropteridae (Table 1).

It was interesting to notice that no orthopteran species was recorded in the four main sampling sites in Satoyama (Table 2). However, seven species were recorded at three of the main sampling sites (Table 2): *Oxya yezoensis*, *Teleogryllus emma*, *Velarifictorus mikado*, *Tenodera angustipennis*, *Tetrix japonica*, *Eobiana gradiella ichikawa* and *Gampsocleis mikado* (Table 2). The majority of these seven species were collected from Kitadan Valley, Zontan area and Kakuma Campus grasslands (Table 2). However, only *Velarifictorus mikado* was recorded in Kitadan Valley, Kanazawa Campus grasslands and Kanazawa Castle Park and was absent in Zontan area (Table 2).

Table 2. Distribution of orthopteran species among different sampling sites of Satoyama area (data combined for 2008 and 2009)

Acridid species	Kitadan Valley (36.5457N & 136.694E)	Zontan area (36.560N & 136.682E)	Kakuma Campus grasslands (36.546N & 136.708E)	Kanazawa Castle Park (36.561N & 136.656E)
Acrida cinerea			+	+
Stethophyma magister	+	+		
Parapodisma mikado	+	+		
Aiolopus thalassinus tumulus			+	+
Eusphingonotus japonicas			+	
Oedaleus infernalis			+	+
Trilophidia annulata			+	+
Oxya yezoensis	+	+	+	
Oecanthus simulator ichikawa			+	
Acheta domesticus		+		
Loxoblemmus equestris			+	
Loxoblemmus sylvestris		+		
Loxoblemmus tsushimensis ichikawa		+		
Stethophyma magister		+		
Teleogryllus occipitalis	+	+		
Teleogryllus emma	+	+	+	
Velarifictorus asperses	+			
Velarifictorus mikado	+		+	+
Velarifictorus ornatus		+		
Modicogryllus siamensis		+		
Sclerogryllus punctatus		+		
Mecopoda niponensis	+			
Ducetia japonica		+	+	
Phaneroptera falcate		+	+	
Phaneroptera nigroantennata		+		
Atractomorpha lata			+	+
Tenodera angustipennis	+	+	+	
Tenodera aridifolia	+			
Criotettix japonicas		+		
Euparatettix tricarinatus			+	
Tetrix japonica	+	+	+	
Tetrix macilenta		+		
Tetrix minor ichikawa		+	+	
Tetrix nikkoensis			+	
Tetrix silvicultrix ichikawa			+	
Conocephalus japonica			+	+
Conocephalus melaenus		+		
Euconocephalus varius		+		
Ruspolia dubia		+		
Chizuella bonneti	+	+		
Eobiana gradiella ichikawa	+	+	+	
Eobiana engelhardti subtropica	+	+		
Gampsocleis mikado	+	+	+	
Hexacentrus japonicas		+		
Tettigonia orientalis		+		
Tettigonia sp 6*		+		
Tettigonia sp 8*		+		
Dianemobius furumagiensis				
Pteronemobius fascipes			+	
Trigonidium pallipes		+		

* According to Ichikawa et al. (2006)

Discussion

From the gathered results of orthopteran assemblage and their community structure in different sampling sites, it could be suggested that the orthopteran assemblages were moderately species rich in some sites and poor in others. The highest richness was recorded from different sampling sites in Zontan area. However, the relatively poor assemblage was detected in forest margins of Kitadan Valley. The species compositions of the collected orthopteran species were quite different in the study sites within Satoyama. In general, orthopteran species were not present in all the studied sites of Satoyama, characterizing their ubiquitous nature. While many species were exclusively found in a definite sampling site and were likely to show high habitat specificity, these results are in accordance with other findings on different orthopterans or acridids assemblages in different localities (Thiele 1977; Luff 1982; Horvatovich 1986; van Dijk 1987; Sunose 1992; Lövei & Sunderland 1996; Olsson et al. 2000).

It has to be mentioned that there were high variations in species composition among different sampling sites within Satoyama (Kato 2001, ElSayed & Nakamura 2010). This could be explained by the differences between the habitats. These sampling sites composed different kinds of 'elements' as suggested by Rainio & Niemelä (2003), and ElSayed (2010). Grasslands in Zontan area, for instance having more refuges, relatively good levels of moisture, many dietary feeding resources or preys could be encountered as a result of the presence of relatively good canopy, etc. These grasslands have favored levels of moisture that attract species for breeding, feeding and overwintering (ElSayed 2010; Pfiffner & Luka 2000). Moreover, arable and floral rich lands are known to be species rich of Orthoptera, especially acridids, as suggested by Purtauf et al. (2003) which are common components in agroecosystem and feed on various arthropods, weeds, seeds and slugs (Sunderland 1975).

Few numbers of orthopteran species were probably able to utilize these sources of such habitat for enhancing their breeding and feeding. In addition, sampling sites subjected to regular man-made disturbances including removal of weeds and other plant species that grow wildly, mowing regimes and rearrangement of field rims of these fields have relatively fewer species and higher number of individuals. These human-made disturbances are conceivably altering the necessary sources for orthopteran species in a way that these sources could not be used by all orthopteran species. Thus, few orthopteran species could utilize, or harshly utilize these resources and increase in their individuals comparing with other orthopteran species. In addition, grasslands of Kakuma Campus were relatively poor in their canopy reflecting the relatively poor species richness in these sampling sites over the two-year study period.

It has to be mentioned that the landscape composition variables showed a significant effect on Orthoptera diversity (Marini et al. 2010, 2011). The Orthoptera species richness and composition were also significantly related to the proportion of grassland in the surrounding landscape (Marini et al. 2010, 2011). *Chorthippus parallelus* benefited from a large proportion of grassland, while most of the species belonging to Ensifera and Caelifera were affected negatively. At the landscape scale, an enhanced mortality because of mowing of large areas is suggested to be the main constraint to high diversity of Orthoptera communities (Gardiner 2006; Marini et al. 2010, 2011). In contrast, in landscapes with a low proportion of grassland, the local diversity could benefit from the presence of ecotonal habitats such as forest edges, hedgerows and bushes (Marini et al. 2010). Grassland areas possibly accumulated more visiting species from these habitats by providing suitable conditions for foraging and reproduction as cited by Gardiner (2006) and Marini et al. (2010).

REFERENCES

Brusven, M.A. & G.B. Mulkern (1960). The use of epidermal characteristics for the identification of plants recovered in fragmentary condition from the crops of grasshoppers. *North Dakota Agricultural Experimental Station Research Reports* 3: 11.

Capinera, J.L, C.W. Scherer & J.B. Simikins (1997). Habitat associations of grasshoppers at the Macarthur agro-ecology research center, Lake Placid, Florida. *Entomologist* 80(2): 255–261.

ElSayed, W.M. (2003). Grasshopper (Orthoptera: Acrididae) communities in Abu Rauwash District. PhD Thesis. Cairo University, 169pp.

ElSayed, W.M. (2010). Diversity anad structure of ground beetle (Coleoptera: Carabidae) assemblages in Satoyama. PhD Thesis. Kanazawa University, Japan, 123pp.

ElSayed W.M. & M. ElShazly (2006). The structure and host

plant selection of an acridid community on the edge between a desert- and an agro-ecosystem in Egypt. *Environmental Informatics Archives* 4: 1–25.

ElSayed W.M. & K. Nakamura (2010). Abundance, diversity and distribution of the ground beetles (Coleoptera: Carabidae) in a Satoyama Valle in Kanazawa, Japan, with special reference to the body size and feeding categories. *Far Eastern Entomologists* 205: 1–20.

Gardiner, T. (2006). The Impact of Grassland Management on Orthoptera Populations in the UK. Unpublished PhD Thesis. University of Essex, Colchester, UK.

Horvatovich, S. & I. Szarukán (1986). Faunal investigation of ground beetles (Carabidae), in the arable soils of Hungary. *Acta Agronomica Academiae Scientiarum Hungaricae* 35: 107–123.

Ichikawa, A., Y. Kano, Y. Kawai, M. Kawai, O. Tominago & T. Murai (2006). *Orthoptera of the Japanese Archipelago in Color—2nd Edition.* Hokkaido University Press, Hardcover, 687pp. (In Japanese).

Joshi, P.C., J.A. Lockwood, N. Vashishth & A. Singh (1999). Grasshopper (Orthoptera: Acridoidea) community dynamics in a moist deciduous forest in India. *Journal of Orthopteran Research* 8: 17–25.

Kato, M. (2001). 'Satoyama' and biodiversity conservation: 'Satoyama' as important insect habitats. *Global Environment Research* 5: 135–149.

Lövei, G.L. & K.D. Sunderland (1996). Ecology and behavior of ground beetles (Coleoptera: Carabidae). *Annual Review of Entomology* 41: 231–256.

Luff, M.L. (1982). Population dynamics of Carabidae. *Annals of Applied Biology* 101: 164–170.

Marini, L., R. Bommarco, P. Fontana & A. Battisti (2010). Disentangling area and habitat diversity effects on orthopteran species with contrasting mobility. *Biological Conservation* 143: 2164–2171

Marini, L., E. Bona, W.E. Kunin & K.J. Gaston (2011). Exploring anthropogenic and natural processes shaping fern species richness along elevational gradients. *Journal of Biogeography* 38: 78–88

Mayya, S., K.S. Sreepada & M.J. Hegde (2005). Survey of short-horned grasshoppers (Acrididae) from Dakshina Kannada District, Karnataka. *Zoos' Print Journal* 20(9): 1977–1979.

Mulkern, G.B. & J.F. Anderson (1959). A technique for studying to the food habits and preferences of grasshoppers. *Journal of Economic Entomology* 52: 342.

Olsson, E.G.A., G. Austrheim & S.N. Grenne (2000). Landscape change patterns in mountains, land use and environmental diversity, Mid-Norway 1960–1993. *Landscape Ecology* 15: 155 – 170.

Pfiffner, L. & H. Luka (2000). Overwintering of arthropods in soils of arable fields and adjacent semi-natural habitats. *Agriculture, Ecosystems and Environment* 78: 215–222.

Purtauf, T., J. Dauber & V. Wolters (2003). Carabid communities in the spatio-temporal mosaic of a rural landscape. *Landscape and Urban Planning* 67(1–4): 185–193.

Rainio, J. & J. Niemelä (2003). Ground beetles (Coleoptera: Carabidae) as bioindicators. *Biodiversity Conservation* 12: 487–506.

Risser, P.G., E.C. Birney, H.D. Blocker; S.W. May, W.J. Parton & J.A. Wiens (1981). *The True Prairie Ecosystem*. Hutchinson Ross Pub. Co., Stroudsburg, Penn, 557pp.

Scott, J.A., N.R. French & J.W. Leetham (1979). Pattern of consumption in grasslands, pp. 89–105. In: French, N.R. (ed.) *Perspectives in Grassland Ecology*. Springer-Verlag, New York.

Sunderland, K.D. (1975). The diet of some predatory arthropods in cereal crops. *Journal of Applied Ecology* 12: 507–515.

Sunose, T. (1992). A comparison of carabid and silphid assemblages in Minuma Greenbelt. *Nature & Insects, Tokyo* 27(2): 13–15. (In Japanese)

Thiele, H.U. (1977) *Carabid Beetles in Their Environments.* Springer Verlag, Berlin, 369pp.

van Dijk, T.S. (1987). The long-term effects on the carabid fauna of nutrient impoverishment of a previously arable field. *Acta Phytopathologica et Entomologica Hungarica* 22: 103–118.