



## Orthopteroids in Kaziranga National Park, Assam, India

N. Senthilkumar

Rain Forest Research Institute, P.O. Box No. 136, A.T. Road (East), Jorhat, Assam 785 001, India  
Present Address: Institute of Forest Genetics and Tree Breeding, Coimbatore, Tamilnadu, India  
Email: [senthilnk@icfre.org](mailto:senthilnk@icfre.org)

**Abstract:** Thirty-six species of orthopteroids belonging to 30 genera, and four families were recorded in different habitats viz., forestlands, savannahs and grasslands of the Kaziranga National Park (KNP) at Assam. The observations were recorded during the period of three years from January 2007 to December 2009, by periodical monthly visits to Kohora range (central range), Baguri range (western range) and Agoratoli range (eastern range) based on the habitat types selected. The family Acrididae had the largest species representation (19 species) followed by Tettigoniidae (nine species) and Mantidae (five species) while Gryllidae was represented by three species only. None of the species found in the study area are known to be threatened under any category of IUCN, 2010.

**Key words:** Acrididae, Biodiversity, Gryllidae, Mantidae, Orthoptera, Tettigoniidae.

The Kaziranga National Park (KNP), over an area of 430km<sup>2</sup> and bounded by the Mikir Hills on the south and the Brahmaputra River on the north lies between 26°30'-26°45'N & 93°08'-93°36'E within two districts - Nagaon and Golaghat, in the Indian state of Assam. The KNP is approximately 40km from east to west, and 13km from north to south with elevation ranging from 40 to 80 m above sea level. Average temperature ranges from 5 to 37 °C and average humidity ranges between 65% and

95%. Rainy season is May to October, and the annual rainfall is about 2500mm.

The four main types of vegetation, alluvial inundated grasslands, alluvial savanna woodlands, tropical moist mixed deciduous forests, and tropical semi-evergreen forests exist in the park. There is a decline in altitude from the east to west. The western reaches are dominated by grasslands. Tall elephant grass is found on higher ground, while short grasses cover the lower grounds. Common tall grasses are spear grass, elephant grass, and the common reed. Numerous forbs are present along with the grasses. Amidst the grasses, providing cover and shade are scattered trees-dominant species including Kumbhi, Indian Gooseberry, The Cotton Tree (in savanna woodlands), and Elephant Apple (in inundated grasslands). Thick evergreen forests have trees of *Aphanamixis polystachya*, *Talauma hodgsonii*, *Dillenia indica*, *Garcinia tinctoria*, *Ficus rumphii*, *Cinnamomum bejolghota*, and species of *Syzygium*. Tropical semi-evergreen forests have *Albizia procera*, *Duabanga grandiflora*, *Lagerstroemia speciosa*, *Crateva unilocularis*, *Sterculia urens*, *Grewia serrulata*, *Mallotus philippensis*, *Bridelia retusa*, *Aphania rubra*, *Leea indica*, and *Leea umbraculifera*. An invasive species, *Mimosa invisa*, which is toxic to herbivores is found in the park (UNEP-WCMC, 2009).

The KNP, home to the world's largest population of the Great Indian One-Horned Rhinoceros, Wild Asiatic Water Buffalo and Eastern Swamp Deer has significant breeding populations of 35 mammalian species, of which 15 are threatened as per IUCN Red List. It also has the highest density of tigers in the world (1 per 5 km<sup>2</sup>), with a population of 86, as per the latest census. Nine of the 14 primates of India, and the only ape, the Hoolock Gibbon (UNEP-WCMC 2009) occur in the park. Most of the forest areas (51.14km<sup>2</sup>) have eroded due to perennial rains and flooding in the Brahmaputra with loss of biodiversity. There is no authentic record on the insect fauna of The Kaziranga National Park, and hence this initial step, on inventorying the Orthoptera fauna of the park.

### Methods

Diverse habitats in KNP, were surveyed monthly, for assessing the distribution and diversity of Orthoptera, from January 2007 to December 2009. Three habitat types representing forestlands, savannahs and grasslands

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**Table 1. Habitat-wise distribution of Orthoptera and Mantodea in Kaziranga National Park, Assam**

Sno	Species	Family	Forest	Savannah	Grassland
1	<i>Xenocatantops humilis</i> (Serv.)	Acrididae	+	+	+
2	<i>Phlaeoba infumata</i> Brun.	Acrididae	+	+	+
3	<i>Phlaeoba tenebrosa</i> (Walk.)	Acrididae	-	+	+
4	<i>Spathosternum prasiniferum</i> (Walk.)	Acrididae	+	-	-
5	<i>Atractomorpha crenulata</i> (Fab.)	Acrididae	-	+	+
6	<i>Catantops ferruginuosus</i> (Walk.)	Acrididae	+	+	+
7	<i>Gesonula punctifrons</i> (Stal.)	Acrididae	-	+	+
8	<i>Phlaeoba antennata</i> Brunner von Wattenwy	Acrididae	+	-	-
9	<i>Phlaeoba</i> sp.	Acrididae	-	+	-
10	<i>Trilophidia annulata</i> (Thunb.)	Acrididae	+	-	-
11	<i>Caryanda</i> sp.	Acrididae	+	-	-
12	<i>Atractomorpha</i> sp.	Acrididae	-	+	+
13	<i>Tagasta indica</i> Bolívar	Acrididae	+	-	-
14	<i>Oxya hyla hyla</i> (Serv.)	Acrididae	-	-	+
15	<i>Heiroglyphus banian</i> (Fab.)	Acrididae	-	+	+
16	<i>Eyprepocnemis alacris</i> (Serv.)	Acrididae	-	+	+
17	<i>Orthacris maindroni</i> Bol.	Acrididae	-	+	+
18	<i>Acrida exaltata</i> (Walk.)	Acrididae	-	+	+
19	<i>Oxya nitidula</i> (Walk.)	Acrididae	-	-	+
20	<i>Conocephalus maculatus</i> (Le Guillou)	Tettigoniidae	+	+	+
21	<i>Conocephalus (Xiphidion) melaenus</i> (De Haan)	Tettigoniidae	+	-	-
22	<i>Euconocephalus indicus</i> (Redtenb.)	Tettigoniidae	-	+	+
23	<i>Letana rubescens</i> (Stål)	Tettigoniidae	+	-	-
24	<i>Hexacentrus unicolor</i> Serville.	Tettigoniidae	+	+	-
25	<i>Khaoyaiana</i> sp.	Tettigoniidae	+	-	-
26	<i>Hexacentrus major</i> Redtenb.	Tettigoniidae	+	-	-
27	<i>Elimaea (Orthelimaea) securigera</i> (Brun.)	Tettigoniidae	+	+	+
28	<i>Mirrollia</i> sp.	Tettigoniidae	-	-	+
29	<i>Teleogryllus</i> sp.	Gryllidae	-	+	+
30	<i>Gryllinae</i> sp.	Gryllidae	+	-	-
31	<i>Grylloides sigillatus</i> (Walk.)	Gryllidae	+	+	+
32	<i>Hierodula</i> sp.	Mantidae	-	+	-
33	<i>Creobroter</i> sp.	Mantidae	+	-	-
34	<i>Statilia</i> sp.	Mantidae	-	-	+
35	<i>Tenodera</i> sp.	Mantidae	-	+	+
36	<i>Mantodea</i> sp.	Mantidae	+	-	-

+ - Presence; - - Absence

were chosen at Kohora range (central range), Baguri range (western range) and Agoratoli range (eastern range) respectively.

**Inventorying protocol:** Representative habitat types were selected and survey plots were laid. Each survey plot was divided into quadrates measuring 10 x 10 m each and five such were chosen for random sampling. The ground level vegetation was searched, by hand picking the insects from the vegetation, sweep nets

were deployed for collecting samples. This exercise was carried out from 0600 to 0800 hr. and repeated from 1800 to 2000 hr. to enumerate the nocturnal species.

The evening sampling was supplemented with a light trap i.e., a portable light trap following Sanjayan (1994) for Orthoptera. Collected specimens were narcotized with menthol (Naphthalene) crystals and brought into the laboratory, air-dried for preservation as per standard procedures and identification. Specimens collected were

identified following Rentz (1979), Naskrecki (1994, 1996 a,b, 2000), Ingrisich & Shishodia (1997, 1998, 2000), Shishodia (2000a, b), and Senthilkumar et al. (2001, 2002).

**Data analysis:** Shannon's diversity index ( $H'$ ) was calculated since it is well accepted that all species at a site, within and across systematic groups contribute equally to its biodiversity (Ganeshaiyah et al. 1997). In addition, Simpson's diversity index ( $\lambda$ ) as per Ludwig & Reynolds (1988) and coverage estimators were also calculated using the EstimateS software of Colwell (2004).

### Results and Discussion

A total of 36 species of orthopteroids belonging to 30 genera, and four families was recorded from different habitats viz., forestlands, savannahs and grasslands of Kaziranga National Park during the survey period (Table 1). The Family Acrididae had the largest species representation (19 species) followed by Tettigoniidae (nine species) and Mantidae (five species) while Gryllidae was represented by three species only (Fig. 1). Short-horned Grasshoppers were recorded with greater diversity in all the habitats. Grasslands harboured greater number of Orthoptera species (21 species) followed by savannahs (20 species) and forestlands (19 species) (Fig. 2). Four Orthopteran species namely *Xenocatantops humilis* (Serv.), *Phlaeoba infumata* Brun., *Catantops ferruginous* (Walk.) and *Conocephalus maculatus* (Le Guilou) were commonly observed in almost all the habitats. Seventeen species were encountered in both savannahs and grasslands followed by seven species in both forestlands and savannahs and six species in both forestlands and grasslands. *Spathosternum prasiniferum* (Walk.), *Phlaeoba antennata* Brunner von Wattenwyl, *Trilophidia annulata* (Thunb.), *Caryanda* sp., *Tagasta indica* Bolívar, *Conocephalus (Xiphidion) melaenus* (De Haan), *Letana rubescens* (Stål), *Khaoyaiana* sp., *Hexacentrus major* Redtenb., *Gryllinae* sp., *Creobroter* sp. and *Mantodea* sp. were recorded only in forests, while *Hierodula* sp. and *Phlaeoba* sp. were encountered in savannahs alone. A greater diversity of short-horned grasshoppers was recorded in all the habitats viz., grasslands, savannahs and forestlands in KNP. This conforms to the host plant distribution hypothesis (Cornell & Lawton 1992). Orthoptera diversity is related to the ecosystem, the grassland and savannah habitats facilitating greater species inhabitation (Senthilkumar et al. 2009). Grasshoppers capable of feeding on grasses in spite of high silica content (Chand & Muralirangan 2006) take refuge in the grasslands. Heterogeneous conditions form the basis of a stable and well-balanced environment in which populations of orthopterans oscillate within certain limits (Senthilkumar et al. 2006). This observation is in consonance with the study of acridid diversity in Tamilnadu (Senthilkumar et al. 2009). The finding of uniqueness of certain species in particular habitats suggested that

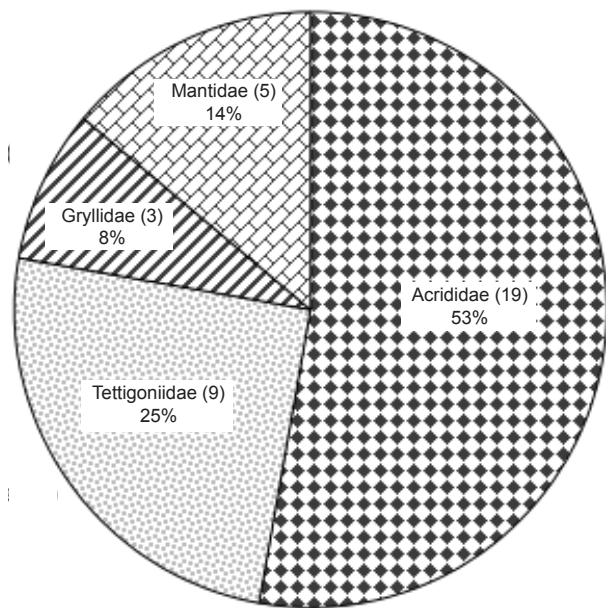


Figure 1. Orthopteroid faunal composition in Kaziranga National Park, Assam

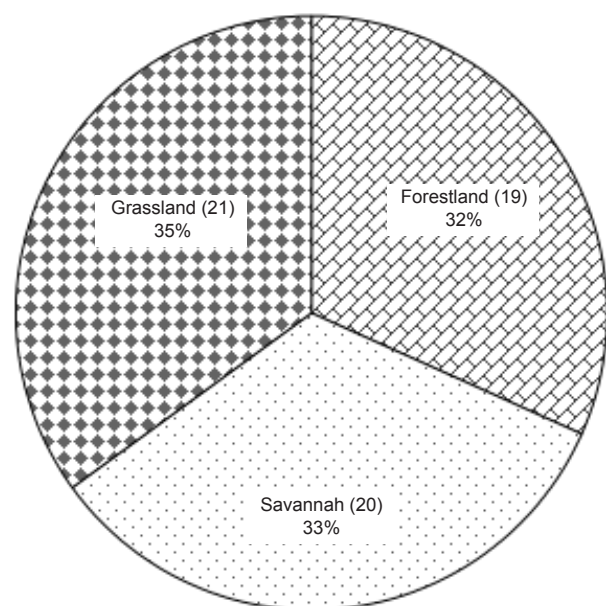


Figure 2. Orthopteroid species richness with reference to habitat types in Kaziranga National Park, Assam

most of the grasshoppers are highly selective to host plants or habitats as Mulkern (1967) reported. *Oxya hyla* (Serv.), *Oxya nitidula* (Walk.) and *Statilia* sp. were represented only in the grasslands.

As a measure of diversity within a habitat, Fisher's alpha, and Shannon's diversity indices were calculated. Fisher's  $\alpha$  index indicates richness of the Orthopteran species in descending order from the forests, the grasslands, and lastly the savannahs. The diversity

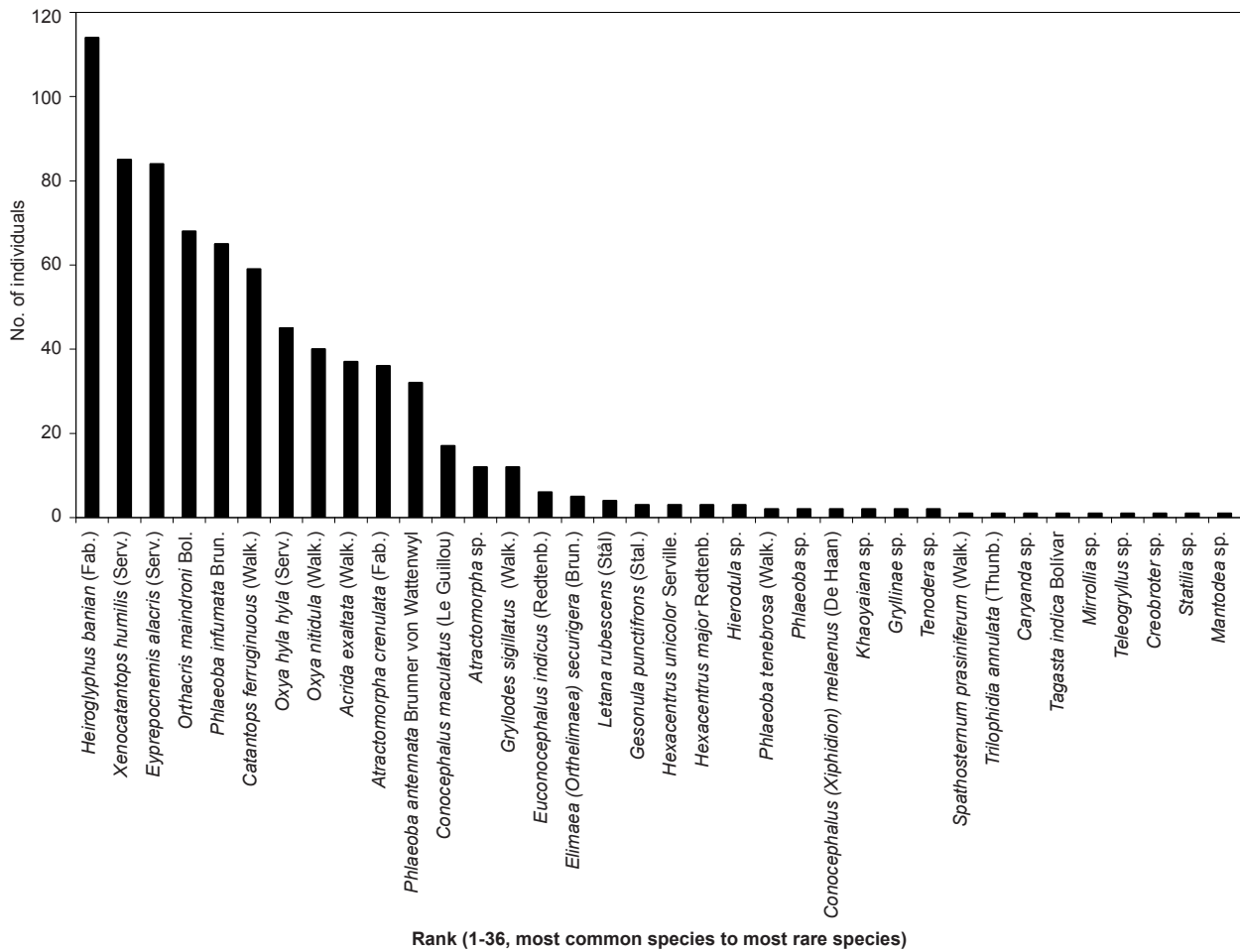


Figure 3. Log series distribution pattern of orthopteroids in Kaziranga National Park, Assam

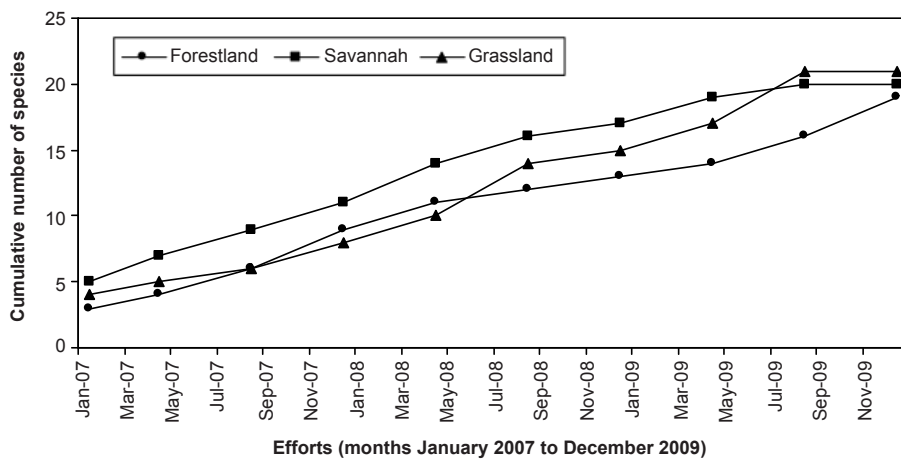


Figure 4. Species accumulation curve of orthopteroids in Kaziranga National Park, Assam

indices  $H'$ , and  $\lambda$  appear useful as they incorporate both species richness and evenness into a single value. Shannon's ( $H'$ ) diversity index appears to have more value (2.28 to 2.4) (Table 2). The present study indicates that orthopteran species are more diverse in KNP. Distribution

of orthopteran species confirmed the log series distribution pattern (Fig. 3) thereby giving creditability to the Fisher's  $\alpha$  values. Simpson's diversity index, ' $\lambda$ ', gives high value for grasslands (8.4), followed by savannah (7.56) and the forestland (7.19).



**Table 2. Species diversity indices of orthopteroid fauna in Kaziranga National Park, Assam**

Indices		FI	S	GI
Species richness		19	20	21
Diversity indices	Alpha ( $\alpha$ )	7.76	5.35	5.59
	Shannon (H')	2.28	2.35	2.4
	Simpson ( $\lambda$ )	7.19	7.56	8.4
Estimators	ACE (%)	46.54	27.26	25.6
	ICE (%)	35.13	30.59	25.64

FI - Forestland; S - Savannah; GI - Grassland; ACE - Abundance Based Coverage Estimator; ICE - Incidence Based Coverage Estimators

Since a complete inventorying is impractical, extrapolation techniques are widely employed for estimation of diversity with more intensive sampling. In the present investigation the species accumulation curve did not attain asymptote even after 36 sampling units with monthly intervals. Sanjayan et al. (2002) found that even after 24 sampling efforts (months), the species accumulation curve did not reach asymptote for orthoptera. It is also reflected in the values of the ACE (Abundance based coverage estimator) (46.54%) and ICE (Incidence based coverage estimator) (35.13%). This also indicates the possibility for encountering more species in KNP as against what the mean species accumulation curve depicted (Fig. 4). This study indicates that distribution, diversity and richness of orthopterans in different habitat types of KNP are related to the availability of host plants, subject to the prevailing ecological conditions. It is also important to note that a few species are endemic to Assam, in the eastern sub Himalayas, one of the mega biodiversity hot spots of the world. Therefore Orthopteran faunal diversity of Assam, especially the KNP has to be protected.

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