Fauna of Protected Areas - 29:
ORTHOPTERAN FAUNA OF THE GIBBON WILDLIFE SANCTUARY, ASSAM

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Abstract

A checklist of 25 species of Orthoptera recorded from the Gibbon Wildlife Sanctuary is presented here along with a series of indices such as Simpson's, Hill's, Margalef's, Mehinick's and evenness. The order is comprised of 25 species of 21 genera and 12 families. This preliminary study indicates many more species yet to be recorded from the area.

Keywords

Gibbon Wildlife Sanctuary, northeastern India, Orthoptera

Gibbon Wild Life Sanctuary is located in Jorhat district of Assam, India. The Sanctuary covers an area of 19.49km^2 of tropical semi evergreen forest on the flat plains of Brahmaputra river. It extends between 26^{0}40'-26^{0}45'N & 94^{0}20'-94^{0}25'E. The altitudinal range is 100-120m. Average temperature ranges from 27.9^{0}C to 18.95^{0}C and average humidity ranges between 64.5% and 94.5 %. Annual rainfall of the study site is 249cm. The Sanctuary is rich in floral composition including trees like *Dipterocarpus retusus* B.L., *Terminalia myriocarpa* Heurek *et* Muell., *Michelia champaca* Linn., *Canarium resiniferum* L., *Castanopsis* sp. Spach. etc. The Sanctuary also has plantations of highly valued plants of *Dipterocarpus retusus* and *Aqualaria agolacha* Roxb. The diverse life forms of the forest includes the world famous Indian ape, Hoolock Gibbon *Hoolock hoolock* hoolock (Harlan), Stumped-tailed Macaque *Macaca arctoides*, Pig-tailed Macaque *Macaca leonina*, Capped Langur *Trachypithecus pileatus* (Blyth) along with elephants, leopards, reptiles like pythons and numerous birds.

The Gibbon Wildlife Sanctuary in the northeastern region of India has not been subjected to serious scientific studies and the status of available scientific information is meager. Most of the forest areas have degraded due to large scale felling of trees in the past for tea cultivation. The people of nearby villages are dependent on the sanctuary mostly for firewood, which is the main cause of degradation of the forest resulting in threats to biodiversity. There is no authenticated record of the insect fauna of the Sanctuary, and therefore a study was initiated as an initial step on inventorying the orthopteran fauna.

Methods

Surveys were conducted during July 2003 to June 2005 (4 times at 6 months interval) where the entire ground level vegetation was covered during the intensive search method involving hand picking the insects from the vegetation after locating them and sweep netting. Sanjayan (1994) showed that this was the best sampling methods for Orthoptera. Orthoptera were observed/collected between 0700 and 1300hr. Collected specimens were narcotized with menthol (Naphthalene) crystals and brought into the laboratory and air-dried for identification. All the specimens were examined carefully and identified specimens were labeled and preserved in insect boxes. A cotton wad immersed in preservative (Phenol, Naphthalene, and Para dichlorobenzene in equal ratio) was kept in the corner of the box to restrict ant and fungal attack. The specimens collected were identified using various publications of Kirby (1914), Henry (1932), Chopard (1969), Rentz (1979), Tanton and Shishodia (1972), Ingrisch (1990, 2002), Ingrisch and Shishodia (1997, 1998, 2000), Shishodia (2000a,b), Shishodia and Tandon (1990), Naskrecki (1994, 1996a,b, 2000), Naskrecki and Otte (1999), and Senthilkumar *et al*. (2001, 2002).

As a measure of á-diversity (diversity within a habitat), the most popular and widely used 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 (Ganeshaiah *et al*., 1997). In addition, Simpson's diversity index (l), Hill's first (N1) and second (N2) abundance numbers, Margalef's richness index (R1), Menhinick's richness index (R2), and Evenness indices (E1, E2, E3, E4 and E5) were also calculated as per Ludwig and Reynolds (1988).

Results and Discussion

During the course of the study, 25 species of Orthoptera belonging to 21 genera, 12 subfamilies and four families were recorded in the Gibbon Wildlife Sanctuary (Table 1). Of the 25 species, five species, *viz*., *Sanaa imperialis* (White, 1846), *Tegra viridivitta* (Walker, 1870), *Phyllomimus assimilis* (Walker, 1869), *Pseudophyllus titan* White, 1846, and *Conocephalus posticus* (Walker, 1869) were previously known only from Sylhet, Bangladesh (Naskrecki & Otte, 1999). *Conocephalus* (*Xiphidion*) *melaenus* was recorded for the first time in Assam during this study. *Conocephalus melaenus* (De Haan, 1842) is distributed from China to Sulawesi. Ingrisch and Shishodia (1998) reported *C. melaenus* for the first time from India in Aizwal, Mizoram. Species *Choroedocus robustus* (Serville, 1839) were known only from Assam and Nepal (Ingrisch, 2002). The Family Tettigoniidae had the largest species representation (13 species) followed by Acrididae (7 species) and Pyrgomorphidae (3 Species) while the Gryllidae was represented by two species only. Out of the 25 species, 15 species were singleton species (single individual), five were represented by two individuals, and the rest were more than two. The larger the number of singletons within a sample, for a given number of doubles, the greater will be the difference between observed and the true species richness for the assemblages sampled (Senthilkumar, 2003). Local richness can be estimated by extrapolating species accumulation curves, fitting parametric distributions of relative abundance, or using non-parametric techniques based on the

Manuscript 1442a; Received 26 September 2005; Finally accepted 18 May 2006; Date of publication 21 July 2006

Table 1. Orthoptera species collected from the Gibbon Wildlife Sanctuary, Assam

	Species	Subfamily	Family	Relative abundance (%)	Relative density (%)
1	*Hieroglyphus banian* (Fabricius, 1798)	Catantopinae	Acrididae	4	1.92
2	*Apalacris* sp.	Catantopinae	Acrididae	8	3.85
3	*Diabolocatantops pinguis* (Stål, 1861)	Catantopinae	Acrididae	4	1.92
4	*Choroedocus robustus* (Serville, 1839)	Euprepocnemidinae	Acrididae	8	3.85
5	*Oxya japonica japonica* (Thunberg, 1824)	Oxyinae	Acrididae	4	1.92
6	*Oxya hyla hyla* Serville, 1831	Oxyinae	Acrididae	4	1.92
7	T*ruxalis indica* (Bolivar, 1902)	Truxalinae	Acrididae	8	3.85
8	*Aularches miliaris pseudopunctatus* Kevan, 1972	Pyrgomorphinae	Pyrgomorphidae	20	9.62
9	*Tagasta indica indica* Bolívar, I., 1905	Pyrgomorphinae	Pyrgomorphidae	4	1.92
10	*Chrotogonus* (*C.*) *oxypterus* (Blanchard, C. E., 1837)	Pyrgomorphinae	Pyrgomorphidae	8	3.85
11	*Conocephalus* (*Xiphidion*) *melaenus* De Haan, 1842	Conocephalinae	Tettigoniidae	4	1.92
12	*Conocephalus* (*Anisoptera*) *longipennis* (De Haan, 1842)	Conocephalinae	Tettigoniidae	4	1.92
13	*Conocephalus maculatus* (Le Gouillou, 1841))	Conocephalinae	Tettigoniidae	4	1.92
14	*Conocephalus posticus* (Walker, 1869)	Conocephalinae	Tettigoniidae	4	1.92
15	*Euconocephalus indicus* (Redtenbacher, 1891)	Copiphorinae	Tettigoniidae	4	1.92
16	*Hexacentrus unicolor* Serville, 1831	Listroscelidinae	Tettigoniidae	4	1.92
17	*Mecopoda elongata* (Linneaus, 1758)	Mecopodinae	Tettigoniidae	16	7.69
18	*Phaneroptera gracilis* Burmeister, 1838	Phnaeropterinae	Tettigoniidae	20	9.62
19	*Sanaa imperialis* (White, 1846)	Pseudophyllinae	Tettigoniidae	24	11.54
20	*Sathrophyllia rugosa rugosa* (Thunberg, 1815)	Pseudophyllinae	Tettigoniidae	28	13.46
21	*Tegra viridivitta* (Walker, 1870)	Pseudophyllinae	Tettigoniidae	4	1.92
22	*Phyllomimus assimilis* (Walker, 1869)	Pseudophyllinae	Tettigoniidae	8	3.85
23	*Pseudophyllus titan* White, 1846	Pseudophyllinae	Tettigoniidae	4	1.92
24	*Brachytrupes* (*Tarbinskiellus*) *portentosus* (Lichtenstein, 1796)	Gryllinae	Gryllidae	4	1.92
25	*Modicogryllus consobrinus* (Saussure, 1877)	Gryllinae	Gryllidae	4	1.92

distribution of individuals among species or of species among samples (Colwell & Coddington, 1994). Most widely used approach for estimating species richness is based on extrapolation from known species accumulation curve. The species accumulation curve, describes species richness in a local homogeneous assemblage as a function of sampling effort (Colwell & Coddington, 1994). In the present study the species accumulation curve could not attain asymptote after four sampling units with six months interval, i.e., even after 24 months, which indicates that most of the probable species have not been encountered during the inventorying process. It is also reflected in the values of the ACE (Abundance based coverage estimator) (51.48%) and ICE (Incidence based coverage estimator) (89.6%). This indicates that there is scope for encountering more species in GWS as against what the mean species accumulation curve depicted (Fig. 1). This result resommends that further inventorying and monitoring of Orthoptera fauna in GWS should be made in order to arrive at any conclusion regarding endemism/rarity.

The concept of species diversity generally consists of two components, namely species richness and species evenness. The richness indices R1, and R2 were computed by using Ludwig and Reynolds (1988) for GWS. Both these indices were high in GWS (Table 2). Evenness index provides an insight into the relative abundance of the species in the community. E5 approaches zero as a single species becomes more dominant in a community (Sanjayan *et al*., 1995). E5 of GWS was more; it

Table 2. Species diversity indices of the Orthoptera fauna in Gibbon Wildlife Sanctuary

1	Richness indices	N_0 / S	25
2		R_1	6.07
3		R_2	3.47
4	Diversity indices	λ	0.05
5		H'	2.17
6		N_1	8.76
7		N_2	19.61
8	Evenness indices	E_1	0.67
9		E_2	0.35
10		E_3	0.32
11		E_4	2.24
12		E_5	2.39
13	Estimators	ACE	51.48%
14		ICE	89.6%

N_0 - Number of species; R1 - Margalef richness index; R2 - Menhinick richness index; λ - Simpson's diversity index; N1 & N2 - Hill's diversity numbers; H' - Shannon's diversity index; E1 - E5 - Evenness indices; ACE - Abundance based Coverage Estimator; ICE - Incidence based Coverage Estimator

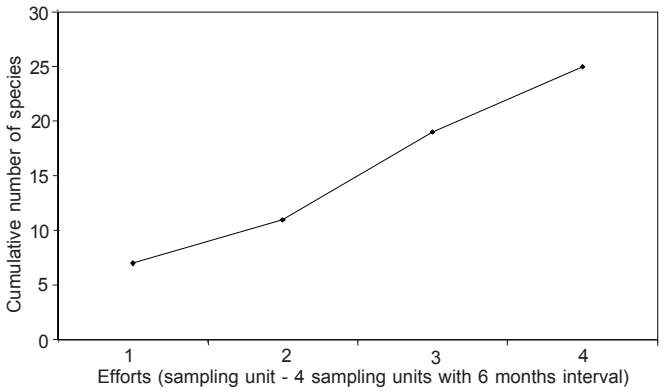

Figure 1. Rarefaction curve (species accumulation curve) for orthopteran faunal assemblages in the Gibbon Wildlife Sanctuary

indicates that the species are evenly distributed. The diversity indices H', N1 and N2 appear useful as it incorporates both species richness and evenness into a single value. Hill's diversity numbers of abundant (N1) and very abundant (N2) species indicate high values, *i.e.*, 8.76 and 19.61 respectively. However, both N1 and N2 are strongly affected by the most abundant species. Hence Shannon's (H') diversity index appears to have more value (2.17) (Table 2). The present analysis indicates higher H' value indicating species to be more diverse in GWS. Simpson's diversity index λ gives low value for Orthoptera species, since the value of l decreases with increasing diversity (Ludwig & Reynolds, 1988).

It is common belief that natural ecosystems are characterized by a great diversity of animal and plant species. These heterogeneous conditions form the basis of a stable and well-balanced environment in which populations oscillate within certain limits (Van Embden & Dabrowski, 1994). This study on Orthoptera has supported the fact that the diverse vegetation types in forestland harboured greater number of insect species. The availability of host plants in the habitat is vital for insect colonization. The type of vegetation in a habitat influences not only species presence, but also relative abundance (Kemp *et al*., 1990). With regard to species diversity namely equitability in the present study, E5 gives a high value of 2.39 clearly indicating that the species are evenly distributed.

In sum, 25 species of Orthoptera fauna recorded in GWS. Importantly, many species are endemic to Assam because of the ecological uniqueness of the region. It is recommended that the GWS be protected not only for gibbons but for all biodiversity.

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Acknowledgements

Authors are grateful to the Director, RFRI, Jorhat for providing facilities during the course of this study and the Forest Department, Assam state for granting permission to work in the Sanctuary. Thanks are also due to Dr. S. Ingrisch, Museum Alexander Koenig, Germany for the confirmation of specimens. Dr. K.P. Sanjayan, G.S. Gill Research Institute, Guru Nanak College, Chennai is greatfully acknowledged for his critical comments on the manuscript.