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### **Diversity and Habitat Preference of Orthopterans in Anamudi Shola National Park, Kerala, India**

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#### **ABSTRACT**

The present study is the first comprehensive documentation on diversity and habitat preference of Order Orthoptera in Anamudi Shola National Park (ASNP). A Quadrat study was conducted in three different habitats in ASNP such as grasslands, sholaforests and monoculture plantations of eucalyptus and wattle to analyze the habitat preference. The sampling period was for fifteen days from 15<sup>th</sup> to 30<sup>th</sup> January 2018. A total of 17 species belonging to two suborders, eight families, 11 subfamilies and 17 genera were recorded during the study period. Three out of the 14 identified species namely, *Gryllus bimaculatus*, *Ducetia japonica* and *Homonemobius monomorphus*, were reported for the first time to the checklist of Orthoptera in Kerala. Acrididae was the most dominant family. The high species diversity in the grassland habitat as compared to Shola and Monoculture Plantation indicates the habitat preference of Orthoptera. Out of the five families identified during quadrat studies, all were observed in grasslands except the family Tetrigidae. The families Chorotypidae, and Trigonidiidae were identified exclusively in grasslands. *Phlaeoba panteli* was the most abundant species in both grassland and monoculture plantations while *Deltonotus gibbiceps* was the abundant species in shola.

**KEYWORDS:** Orthoptera, Grasshopper, Anamudi Shola National Park (ASNP), Grassland, Habitat preference, Acrididae

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## INTRODUCTION

Orthoptera is one of the largest orders of terrestrial insects which form the major primary consumer in many ecosystems. They play important role in food chain and nutrient cycling in forest ecosystem. Over 17,250 species have been reported all over the world. More than 1,750 species, about 10% of the total world species, have been recorded from India and nearly an equal number are yet to be discovered, 1033 species and 21 families have been recorded of Orthoptera from all over the states of India<sup>1</sup>. A total of 130 species of Orthoptera from two suborders have been reported from Kerala<sup>2</sup>.

The Orthopterans are distributed through the physiographic zones of the world but their distribution largely depends upon the vegetation like grasslands, forests and agricultural fields<sup>1</sup>. Though many studies have been conducted elsewhere, no such attempt has ever made in Anamudi Shola National Park (ASNP) to assess the status and diversity of Orthoptera. The present study is conducted to study the diversity and habitat preference of Orthopterans in ASNP.

## MATERIALS AND METHODS

**Study Area:** Anamudi Shola National Park (ASNP), located along the Western Ghats in the Idukki district of the state of Kerala (Figure: 1) with a total area of 7.5 Km<sup>2</sup>, is a part of Annamalai sub-cluster. ASNP include three shola reserve forests; Idivara Shola Reserve, Pullardi Shola Reserve and Mannavan Shola Reserve. The study was conducted in three different habitats in ASNP such as grasslands, sholaforests and monoculture plantations of Eucalyptus and Wattle.

**Methodology:** The specimens were collected by quadrat method and opportunistic observation. 30 quadrates of 10\*10m were laid with a distance of 1 km between each plot. 10 quadrates were made in all three habitats. The observed species were recorded along with date, time, the vegetation type, and the GPS location on quadrat specific datasheets. Orthopterans were collected using insect collecting net. Collected specimen were observed, photographed and released. Orthopterans seen by chance during the walks in between the quadrates were observed, photographed and released. Identification was done using standard field guides<sup>3</sup> and in consultation with Mr. Dhaneesh Bhaskar, Research scholar, Kerala Forest Research Institute, Peechi. 'Orthoptera Species File'- a global taxonomic database Orthoptera was also used as a tool for identification. Data analysis was done using statistical software PRIMER-E.

## RESULTS AND DISCUSSION:

### Diversity:

Seventeen different Orthopterans belonging to 2 suborders, 8 families, 11 subfamilies and 15 genera were recorded. However, a single species of Orthoptera was only reported from Mannavan shola during the studies of insect fauna<sup>4</sup>. Out of this, 14 were identified to species level. The present study reported *Gryllus bimaculatus*, *Ducetia japonica* and *Homonemobius monomorphus*, which were reported for the first time to the checklist of Orthoptera in Kerala<sup>2</sup>.

**Table 1: Checklist to Orthoptera of Anamudi Shola National Park.**

Sl. No.	Family	Subfamily	Genus	Species
<b>SUBORDER CEALIFERA</b>				
1	Acrididae	Acridinae	<i>Phlaeoba</i>	<i>panteli</i> (Bolivar,1902)
2	Acrididae	Acridinae	<i>Phlaeoba</i>	Sp.
3	Acrididae	Acridinae	<i>Carliola</i>	<i>carinata</i> (Uvarov ,1929)
4	Acrididae	Catantopinae	<i>Palniacris</i>	<i>maculatus</i> (Henry,1940)
5	Acrididae	Oxyinae	<i>Oxya</i>	<i>fuscovittata</i> (Marschall 1836)
6	Acrididae	Spanthosterninae	<i>Spanthosternum</i>	<i>prasiniiferum</i> (Walker 1871)
7	Chorotypidae	Prionacanthinae	<i>Prionacantha</i>	<i>picta</i> (Henry, 1940)
8	Mastacideidae	Mastacideinae	<i>Paramastacides</i>	<i>ramachendrai</i> (Bolivar, 1930)
9	Mastacideidae	Mastacideinae	<i>Mastacides</i>	<i>nilgiriscus</i> (Bolivar,1914)
10	Pyrgomorphidae	Pyrgomorphinae	<i>Atractomorpha</i>	<i>crenulata</i> (Fabricus,1793)
11	Tetrigidae	Cladonotinae	<i>Deltonotus</i>	<i>gibbiceps</i> (Bolivar,1902)
12	Tetrigidae	Cladonotinae	<i>Deltonotus</i>	Sp.
<b>SUBORDER ENSIFERA</b>				
13	Gryllidae	Gryllinae	<i>Gryllus</i>	<i>bimaculatus</i> (Thunberg, 1815)
14	Gryllidae	Gryllinae	<i>Cophogryllus</i>	Sp.
15	Trigonidiidae	Nemobiinae	<i>Paranemobius</i>	<i>vicinus</i> (Chopard,1928)
16	Trigonidiidae	Nemobiinae	<i>Homonemobius</i>	<i>monomorphus</i> (Bolivar,1900)
17	Tettigoniidae	Phaneropterinae	<i>Ducetia</i>	<i>japonica</i> (Thunberg,1815)

Among the different Families observed, the Family Acrididae dominated over all other families and Chorotypidae and Pyrgomorphidae were poorly represented.

### Plate I: Orthopteran species observed in ASNP



**Fig 1: *Spanthosternum prasiniiferum***



**Fig 2: *Oxyia fuscovittata***



**Fig 3: *Mastacides nilgiriscus***



**Fig 4:** *Phlaeoba panteli*



**Fig 5:** *Deltonotus gibbiceps*



**Fig 6:** *Paramastacides ramachendrai*



**Fig 7:** *Carliola carinata*



**Fig 8:** *Paranemobius vicinus*



**Fig 9:** *Prionacantha picta*



**Fig 10:** *Palniacris maculatus*



**Fig 11:** *Cophogryllus* sp.



**Fig 12:** *Deltonotus* sp



**Fig 13:** *Gryllus bimaculatus*



**Fig 14:** *Ducetia japonica*



**Fig 15:** *Homonemobius monomorphus*

Table 2: Species reported from different habitats in ASNP during quadrature study

Sl. No.	Family	Name of sps.	Total Number of Individuals	No. of individuals		
				Grassland	Shola	Monoculture
1	Acrididae	<i>Phlaeoba panteli</i>	64	60	0	4
2	Acrididae	<i>Palniacris maculatus</i>	2	2	0	0
3	Acrididae	<i>Oxya fuscovittata</i>	18	18	0	0
4	Chorotypidae	<i>Prionacantha picta</i>	3	3	0	0
5	Mastacideidae	<i>Paramastacides ramachendrai</i>	22	20	2	0
6	Mastacideidae	<i>Mastacides nilgiriscus</i>	12	12	0	0
7	Tetrigidae	<i>Deltonotus gibbiceps</i>	51	0	48	3
8	Tetrigidae	<i>Deltonotus Sp.</i>	1	0	1	0
9	Trigonidiidae	<i>Homonemobius monomorphus</i>	24	24	0	0

**Habitat preference** was studied using the data obtained from quadrates. Nine species belonging to five families were recorded during the quadrature study in ASNP. Of the 5 families identified, all were observed in grasslands except the Tetrigidae. The families Chorotypidae, and Trigonidiidae were identified exclusively in grasslands. Acrididae, the most dominant family preferred grasslands. Acrididae are not simply or passively tracking plant community structure rather, these insects appear to be sensitive to a more complex array of ecological conditions. In general, vegetation has a direct effect on acridid diversity and abundance<sup>5</sup>.

The species *Phlaeoba panteli*, *Paramastacides ramachendrai*, *Oxya fuscovittata*, *Homonemobius monomorphus*, *Mastacides nilgiriscus* were abundant in grasslands. *Oxya fuscovittata*, *Homonemobius monomorphus*, *Mastacides nilgiriscus*, *Prionacantha picta*, *Palniacris maculatus* were found exclusively in grasslands. This may be due to the presence of some host plants in that particular habitat. Most of the grasshoppers are highly selective to host plants or habitat<sup>6</sup>. Most of the grasshoppers exhibit definite host preferences and host plant shifting may occur in grasshoppers, when their main host is absent and may indicate the removal of a particular plant species<sup>7</sup>.

*Deltonotus gibbiceps*, abundant in sholas has unique features to get adapted with the habitat like body colour, size etc. These species exhibit distinctive camouflage. Insect phenology indirectly reflects the population responses to local environmental conditions<sup>8</sup>. Grasshopper activities starts shortly after dawn and are closely linked with the air and soil temperature, wind speed, and light intensity<sup>9</sup>. The absence of host plant species, thereby food resources and lack of light intensity due to tree cover can account for the less species richness of Orthoptera in sholas.

Monoculture plantations (Eucalyptus and Wattle) has less number of species which indicates that these habitats are least preferred by them. Eucalyptus trees can lower the biodiversity and soil quality due to their allelopathic effect<sup>10</sup>. Eucalyptus trees release volatile oils and phenolic acids into

the soil which inhibit growth of other plants in surrounding area<sup>11</sup> which may kill the host plants of grasshoppers and reduce grasshopper diversity.

**Table 3: Biodiversity statistics of different habitats in ASNP.**

Habitat	No. of species (S)	No. of individuals (N)	Species richness (d)	Shannon Diversity Index H'(loge)	Sps. Dominance Lambda	Evenness 1-Lambda
Grassland	7	139	1.2159	1.565	0.2564	0.7436
Shola	3	51	0.50867	0.2612	0.8855	0.1145
Monoculture plantation	2	7	0.5139	0.6829	0.4286	0.5714

**Biodiversity statistics** Grassland has the highest number of species (7), while shola and monoculture has 3 and 2 sps. respectively. Grassland has highest number of individuals of different species (139) and species richness (1.2159). This may be due to the increased availability of host plants, food resources and light intensity. Orthoptera diversity is related to the ecosystem, the grassland and semi evergreen habitat facilitating greater species inhabitation<sup>12</sup>.

The dominance index of shola (0.8855) stands high than that of monoculture (0.4286) and grassland (0.2564). This indicates that some species present in sholas exhibit high abundance compared to the remaining species of that habitat. Grassland shows more evenness in the distribution of its species (0.7436) than shola and monoculture.

**Table 4: Relative abundance of Orthopteran sps. in different habitats of ASNP.**

Name of sps.	Relative abundance			
	ASNP	Grassland	Shola	Monoculture
<i>Phlaeoba panteli</i>	32.49	43.17	0.00	57.14
<i>Palniacris maculates</i>	1.02	1.44	0.00	0.00
<i>Oxya fuscovittata</i>	9.14	12.95	0.00	0.00
<i>Prionacantha picta</i>	1.52	2.16	0.00	0.00
<i>Paramastacides ramachendrai</i>	11.17	14.39	3.92	0.00
<i>Mastacides nilgiriscus</i>	6.09	8.63	0.00	0.00
<i>Deltonotus gibbiceps</i>	25.89	0.00	94.12	42.86
<i>Deltonotus Sp.</i>	0.51	0.00	1.96	0.00
<i>Homonemobius monomorphus</i>	12.18	17.27	0.00	0.00

**Relative Abundance** of Orthoptera based on quadrat study shows that *Phlaeoba panteli* (43.17) is the most abundant sps. in ASNP followed by *Deltonotus gibbiceps* (25.89). *Phlaeoba panteli* is the most abundant species in both grasslands and monoculture plantations while in shola *Deltonotus gibbiceps* is the most abundant sps.



## **CONCLUSION:**

The grasslands with plenty of grasses provide great diversity and species richness of Orthopterans. The availability of host plants in the habitat is vital for insect colonisation. Shola forest also houses unique species. Monoculture plantation is found to be least in diversity due to the allelopathic effects of eucalyptus and wattle trees. The grasslands provide greatest Orthopteran diversity and species richness. Therefore grasslands are crucial for the existence of these ecologically important taxa and they need to be conserved. This is a preliminary study on Orthoptera in Anamudi Shola National Park. Even though the study was for a short duration, it resulted in reporting 17 species with three new reports to Kerala.

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