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Diversity of cockroaches in yelagiri hills part of Eastern Ghats of Tamil Nadu, India

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Abstract
Cockroaches are the oldest insects the earliest fossils dating back to the carboniferous period are about 400 million years. Diversity of cockroaches and their abundance were analyzed at Yelagiri hills lying between 12º 579'N; and 78º.639'E in Eastern Ghats of Tamil Nadu, India. The abundance of Blattids peaked at middle elevations influenced by favorable environment condition and availability of food preference etc., the diversity of cockroaches indicates the influence of habitat, climate and availability food of resources. In this study 633 examples of cockroaches were collected and accommodated under 12 species and 10 genera in 4 families were recorded. This report is first time consolidated report of the family Blattodea from the Tamil Nadu part of Eastern Ghats.

Keywords: Blattodea, Cockroach diversity, Yelagiri hills, Eastern Ghats.

1. Introduction
Cockroaches, otherwise called terrestrial Blattids; distributed in tropical and subtropical areas of the world are the best known species. Virtually domesticated over the millennium, they coexisted with the human civilization despite dislike shown by the humans. There are 5000 known species in worldwide accommodated under eight families, *Nocticolidae, Corydiidae, Ectobiidae, Blaberidae, Blattidae, Lamproblattidae, Tryonicidae, Cryptocercidae* (George Beccaloni, *et al* 2013). The vast majorities of cockroach species (more than 99%) live in the wild and are probably playing an important role in the forest eco system (Bhoopathy, 1997 & Jayakumar *et al.,* 1994). Cockroaches are mostly tropical and distributed in Indo-Malayan region. Cockroaches have emerged as a group insect social evolution due to their phylogenetic proximity to eusocial termites within the Blattodea (Roth et al., 2009). In India, so far 156 species accommodated under 57 genera in 6 were families reported (Mandal et.al., 1995 & 2000). Diversity indices of tropical cockroach were reported by Bonsals (1995) and Padmanaban (2002). This paper reveals that the diversity of Cockroaches in Yelagiri hills in Vellore district of Tamil Nadu. In this hill region is part of Eastern Ghats in Tamil Nadu.
The Eastern Ghats are endowed with an extensively rich variety of biological species, geological formations and different ethnic tribes. In India there is no proper information available on the identification, diversity and the role of blattids in forest ecosystems. Hence, the broad objective of the present study is to identify and calculate the diversity indices of blattid species along with an elevation gradient within the different areas in Yelagiri hills of Eastern Ghats of Tamil Nadu.

2. Materials and Methods
2.1 Study description
The survey was carried out in different dense forest areas of Yelagiri hills a part of Eastern Ghats in Tamil Nadu. In Eastern Ghats region more than 2600 plant species of angiosperms, gymnosperms and pteridophytes were presented. The cockroach samples were collected from January to and December 2013. There are five areas were chosen for our studies and cockroaches were collected from the selected places of dense forest areas of Yelagiri Hills. All the cockroaches were captured using simple gloved hands and sweeping methods and kept in a hole- punched plastic container. The alive samples were transported to the laboratory. The cockroaches were identified using their morphological and taxonomical characteristics

with the help of standard literature and books. Identified samples were deposited in Southern Regional Centre, Zoological survey of India, Chennai.

2.2 Data Analysis

Standard methods were used to calculate the richness and evenness of cockroach species at different altitudes. The diversity indices were calculated using the Ludwig and Reynolds software package. Two indices are needed to compute Hill's diversity numbers:

Simpson's index ∑ = The Sum of N = The total number of dominant species record in one intertidal zone n_i = The number of individuals of one species found in that one intertidal zone n = Total number of individuals found in that one intertidal zone	$D = \sum_{i=1}^{s} \frac{n_i(n_i-1)}{N(N-1)}$
Shannon's index H = Diversity index S = Species count P_i = Proportion of S made up of in ₁th species	$H = -\sum_{j=1}^{S} p_i \ln p_i$

3. Results

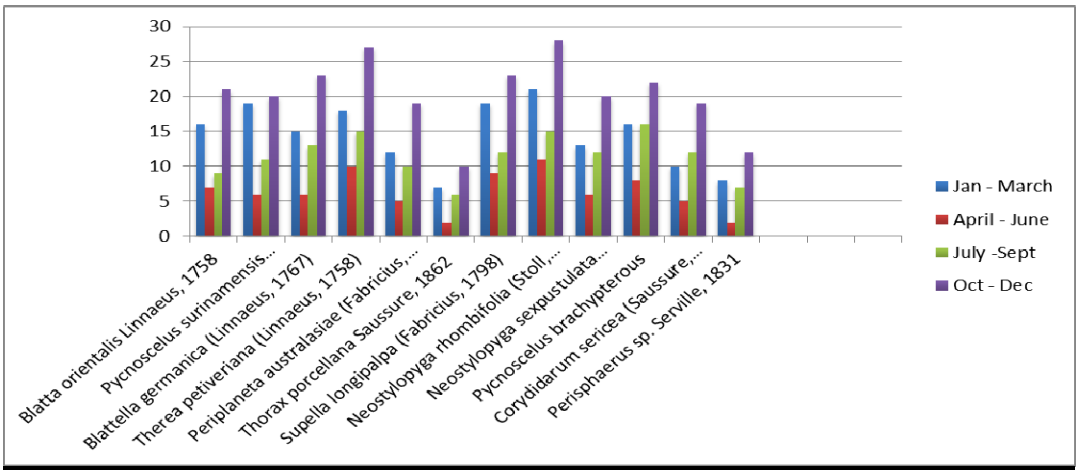
In the present study we have recorded 12 species of cockroaches belonging to 10 genera and 4 families (Table-1) from Yelagiri hills. Family Blaberidae contributed maximum number of species (*Pycnoscelus surinamensis* (Linnaeus, 1758), *Thorax porcellana* Saussure, 1862, *Pycnoscelus* brachypterous, *Corydidarum sericea* (Saussure, 1863), *Perisphaerus* sp. Serville, 1831) followed by family Blattidae (*Blatta orientalis* Linnaeus, 1758, *Periplaneta australasiae* (Fabricius, 1775), *Neostylopyga rhombifolia* (Stoll, 1813), *Neostylopyga sexpustulata* (Walker, 1871) family Blattellidae (*Supella longipalpa* (Fabricius, 1798) family Ectobiidae (*Blattella germanica* (Linnaeus, 1767) and Corydiidae *Therea petiveriana* (Linnaeus, 1758) respectively.

Table 1: List of cockroaches were collected and identified in Yelagiri hills

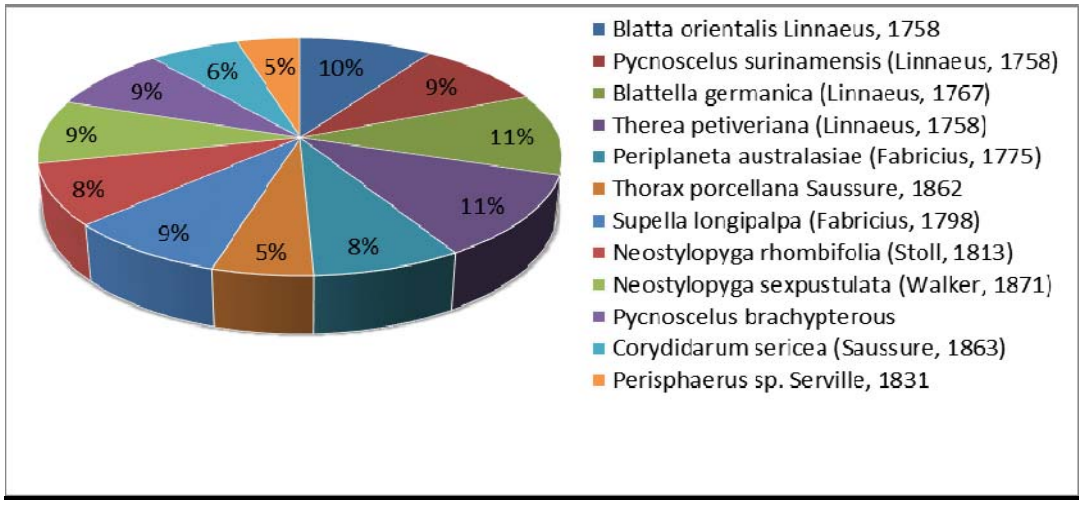
Taxonomical description of cockroaches in Yelagiri Hills	Species Photos
Family: Blattidae Subfamily: Blattinae Genus: Blatta Linnaeus, 1758 Species: *Blatta orientalis* Linnaeus, 1758	
Family: Blaberidae Subfamily: Pycnoscelinae Genus: Pycnoscelus Scudder, 1862 Species: *Pycnoscelus surinamensis* (Linnaeus, 1758)	
Family: Ectobiidae Brunner von Wattenwyl, 1865 Subfamily: Blattellidae Karny, 1908 Genus: Blattella Caudell, 1903 Species: *Blattella germanica* (Linnaeus, 1767)	
Family: Corydiidae Saussure, 1864 Subfamily: Corydiinae Saussure, 1864 Genus: Therea Billberg, 1820 Species: *Therea petiveriana* (Linnaeus, 1758)	

Family: Blattidae Subfamily: Blattinae Genus: Periplaneta Burmeister, 1838 Species: *Periplaneta australasiae* (Fabricius, 1775)	
Family: Blaberidae Subfamily: Epilamprinae Brunner von Wattenwyl, 1865 Genus: Thorax Saussure, 1862 Species: *Thorax porcellana* Saussure, 1862	
Family: Blattellidae Subfamily: Pseudophyllodromiinae Genus: Supella Shelford, 1911 Species: *Supella longipalpa* (Fabricius, 1798)	
Family: Blattidae Subfamily: Blattinae Genus: Neostylopyga Shelford, 1911 Species: *Neostylopyga rhombifolia* (Stoll, 1813)	
Family: Blattidae Subfamily: Blattinae Genus: Neostylopyga Shelford, 1911 Species: *Neostylopyga sexpustulata* (Walker, 1871)	
Family: Blaberidae Subfamily: Pycnoscelinae Genus: Pycnoscelus Species Name: *Pycnoscelus brachypterous*	
Family: Blaberidae Subfamily: Perisphaeriinae Genus: Corydidarum Brunner von Wattenwyl, 1865 Species: *Corydidarum sericea* (Saussure, 1863)	
Superfamily: Blaberoidea Family: Blaberidae Subfamily: Perisphaeriinae Genus: *Perisphaerus sp.* Serville, 1831	

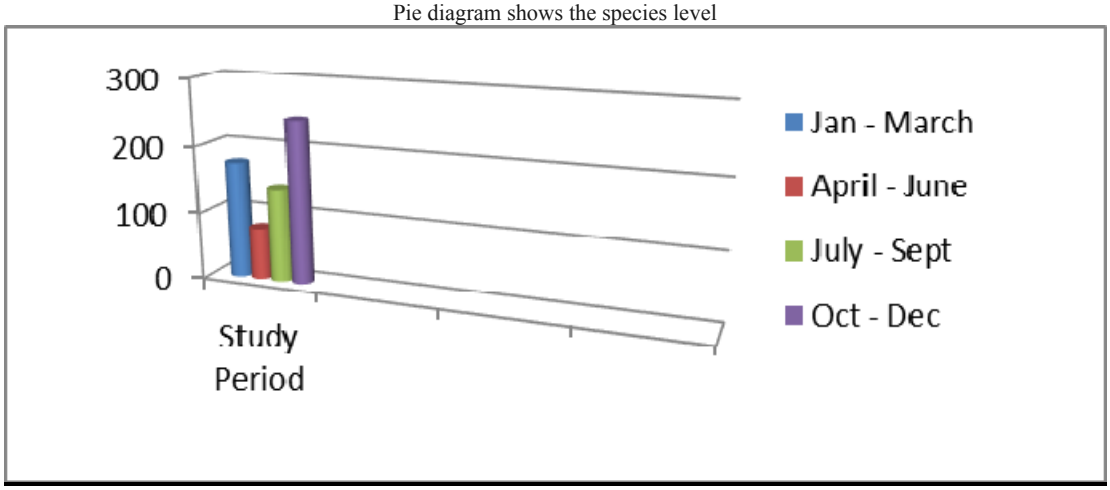
S. No.	Species name	Survey taken 4 Quarter for the year of 2013				Total in species wise
		I	II	III	IV	
		Jan-March	April-June	July-Sept	Oct-Dec	
1	*Blatta orientalis* Linnaeus, 1758	16	7	9	21	53
2	*Pycnoscelus surinamensis* (Linnaeus, 1758)	19	6	11	20	56
3	*Blattella germanica* (Linnaeus, 1767)	15	6	13	23	57
4	*Therea petiveriana* (Linnaeus, 1758)	18	10	15	27	70
5	*Periplaneta australasiae* (Fabricius, 1775)	12	5	10	19	46
6	*Thorax porcellana* Saussure, 1862	7	2	6	10	25
7	*Supella longipalpa* (Fabricius, 1798)	19	9	12	23	63
8	*Neostylopyga rhombifolia* (Stoll, 1813)	21	11	15	28	75
9	*Neostylopyga sexpustulata* (Walker, 1871)	13	6	12	20	51
10	*Pycnoscelus brachypterous*	16	8	16	22	62
11	*Corydidarum sericea* (Saussure, 1863)	10	5	12	19	46
12	*Perisphaerus sp.* Serville, 1831	8	2	7	12	29
Total in month wise		174	77	138	244	
Total						**633**



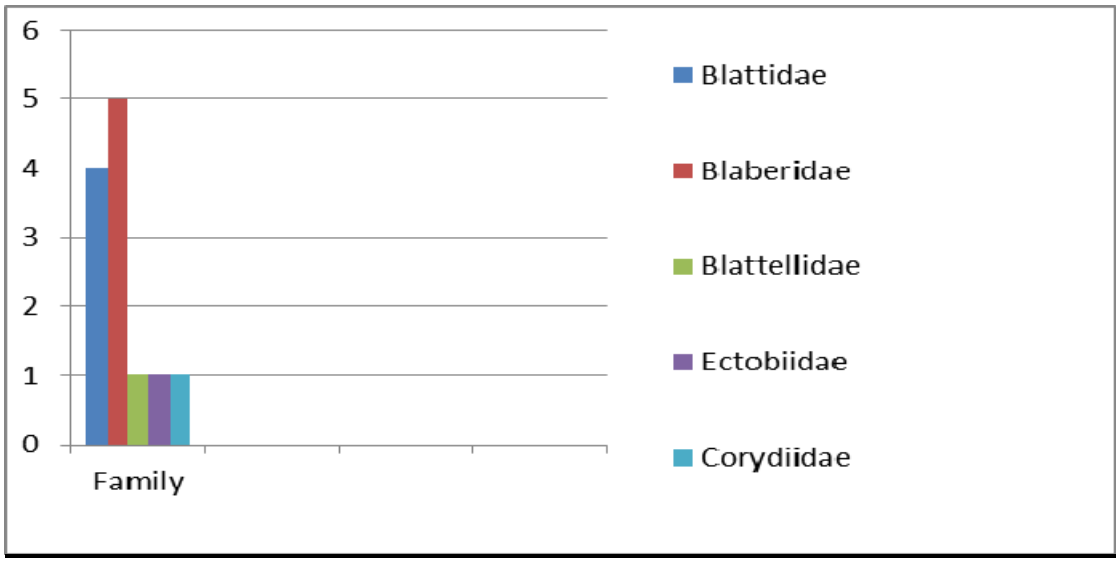
Bar diagram shows species variation in quarter wise.



Pie diagram shows the species level



Bar diagram shows quantity variation in quarter wise.



Bar diagram shows family level of contribution during study period.

4. Discussion

Biological diversity or biodiversity refers to the variety and variability of life on earth. In India with a total geographical area of 329 million hectares is the second largest nation in Asia and seventh in the world. India is fortunately endowed with a wide range of agro climate conditions that support the growth of an equally diverse range of plant and animals. But the loss of biodiversity is a very serious problem of the

country. Several species of the living organisms are disappearing and biodiversity is more threatened now than at any time in the past. It is generally believed that deforestation is the main cause behind the current crisis and along with this global climate change, shifting cultivation, soil erosion, unchecked expansion of urban areas etc., is the other main causes of this problem. The current rate of extinction demands immediate concerted efforts for conservation of biodiversity for future generations, conservation of biodiversity could be accomplished using both in situ and ex situ methods.

As shown here, cockroaches play an important role in degrading plant materials in forest ecosystem. When compared to the species diversity in the world, India 3.8 % cockroach taxa and Tamil Nadu has 30% of the Indian cockroaches. In

this study, the report shows that 12 species of cockroaches belongs to five were identified from Eastern Ghats of Yelagiri hills. This is the first report of the distribution of blattids in the Eastern Ghats of Yelagiri hills. Two diversity indices namely Shannon's index and Simpson's index were calculated. Shannon's index is sensitive to changes in the abundance of rare species in a community. But the Simpson's index is sensitive to changes of the most abundant species in community. These indexes proved much difference in cockroach distribution and diversity. Shannon index assumes that individuals are randomly sampled from in definitely large populations. This index also assumes that all cockroaches are represented in the sample. Simpson's index, which gives the probability of two individuals drawn at random from a populations belonging to the same species increases with the decrease in diversity.

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