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Assessment Scarabaeid Beetle Diversity in Various Cropping Regions of Karnataka

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ABSTRACT

The different agroecological regions of Western Ghats of Karnataka were surveyed to assess the diversity of scarabaeid beetles. The species distribution revealed occurrence of 18 species of scarabaeid beetles. The rutelinid *Anomola albopilosa* was more dominant (21.34%) followed by melolonthinid *Holotricha serrata* (19.22%). *Leucopholus* sp. was more predominant in the Malanad region. Species richness and abundance was determined by the diversity indices. Higher Shannon's Weiner diversity index (2.73) was registered during 2018.

Keywords: Scarabaeid Beetle; Diversity indices; Species distribution

INTRODUCTION

The loss in biodiversity in an ecosystem, due to depletion of native habitat had warranted to have a catalog of species richness. About 30,000 species of scarabaeid beetles were reported [1]. The diverse scarab fauna in India has not been well ascertained. It had been reported about 2500 species of phytophagous scarabaeid beetles from the country; a majority of these are pre-eminently leaf feeders (sub families Melolonthinae, Rutelinae and Dynastinae) and flower/fruit beetles (sub family Cetoniinae) [2].

The larvae of scarabaeid beetles commonly known as white grubs [3] cause widespread losses and damage to the roots of cereals, legume, small ,fruit plants , shrubs and trees [4]. The Western Ghats is one of the centers of rich biodiversity known for unique species. The white grubs occur widely in the cultivated and forest areas of Karnataka and attack crops such as groundnut, sugarcane, millets, chilies, tobacco, pulses , upland paddy, potato, soybean, vegetables , coffee, areca nut and pepper etc.

The diversity of scarabaeid beetles, their richness and relative abundance in the agroecological regions of the Western Ghats of Karnataka has not been fully assessed, the study of which would enable to conserve their habitat and strategize their management.

MATERIALS AND METHODS

Study area

Surveys were carried out in the various cropping regions of the Western Ghats of Karnataka, predominantly the Malanad region at a an altitude of 1222-2479 m MSL (mean sea level), 320° 05′ N to 310° 12′ N Latitude and 760° 32′ E to 770° 25′ E Longitude.

Anthology of adult beetles and identification

The adult beetles were collected from each location using light traps placed above the ground level in the center of the field at one trap per hectare, at a height of 3 meters. The traps were placed from 7 PM to 9 AM to attract and trap the beetles. The light trap comprised of a red colored plastic funnel (25 cm height and 39 cm in diameter) covered with a protective shed cone for the bulb placed at 17 cm on the top of the funnel and the cone is held in position with metal sheets. The bottom of the funnel is attached with nylon bag to collect the entrapped beetles. The source of light contained a bulb (120 Watt) with a copper wire to emit visible bluish light. The entrapped beetles were gathered and segregated species wise and the count of each species was recorded. The abundance and richness of the beetles was assessed based on the rate of occurrence of various species based on the availability of food for larvae and adult, existing soil type and prevailing weather conditions. Species diversity was assessed based on the predominant period of activity of the

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beetles (June to August/September). The scarabaeid adults collected from various locations were taxonomically identifies based on the characters and the keys are developed. The identified beetles were stored in ethanol (95%).

Working out diversity indices

The diversity indices are worked out based on the assumption that individuals are randomly sampled from a considerably huge population. The number of species (richness) and number of individuals (abundance) were employed to assess the diversity. The evenness of the abundance of species as explained by Shannon index (H′) and species richness of the most abundant species by Simpson index (D) was worked out [5]. The diversity indices were determined from all the information gathered during the each year by using the following equations [6].

Shannon diversity index:

$$H' = \log n - \frac{1}{n}\sum_{i=1}^{k} n_i \log n_i$$

Simpson's index of diversity:

$$D = 1 - \sum_{i=1}^{S} (p_i)^2$$

Simpson's Reciprocal Index=1/D

Pielou's evenness index:

$$J' = \frac{H'}{H_{max}}$$

Where

H′ =Shannon diversity index

pi=Proportion of total sample belonging to the i^{th} species

S=Numbers of species

∑=Sum from species 1 to species SD=Simpson's index of diversity

N=Total percentage cover or total number of organisms

n=Percentage cover of a species or number of organisms of a species

J′ =Evenness of allotment of individuals among the species

H_{max}=Maximum species diversity (H')=$\log_2 S$

RESULTS

Study area: Species composition

The topography, soil type and vegetation was considered to study the species composition in the various regions (Table 1) The investigations were carried out at Bangalore (12.97°N, 77.57°E), Chintamani (13.40°N, 78.05°E), Mudigere (13.13°N, 75.64°E) and Malanad regions (Sringeri , Sirsi, Shimoga and Thirthahalli). The soil type in these areas was of red loamy and red sandy with varied cropping pattern that comprised of Rice, Small millets, Maize, Groundnut, sorghum, sugarcane, castor and plantation crops.

Table 1: Characteristics of the study area.

Site	District	Geographical	Cropping pattern	Soil type
Bangalore	Bangalore	12.97°N., 77.57°E	Rice, Small millets, Maize, Groundnut, sorghum, Sugarcane, castor and vegetables	Red laterite and red loamy
Chintamani	Chikballapur	13.40°N., 78.05°E	Rice, Small millets, Maize, Groundnut, sorghum, pulses, sunflower, fruit crops and vegetables	Red loamy, Red sandy
Mudigere	Chickmagalur	13.13°N., 75.64°E	Ragi, Jowar, Maize, pulses, horticultural crops, cardamom, cashew, spices	Red loamy
Malanad region (Chikmagalur, Sringeri, Sirsi, Shimoga, Thirthahalli)	Chikmagalur, Uttarakanada, Shimoga)	12.57-13.52°N., 75.72-75.22°E	Millets, maize, pulses. Arecanut, cocoa, sugarcane, coffee, cardamom and spices	Red loamy

Species distribution and abundance

Eighteen species of scarabaeids were recorded in the areas studied. The common scarabaeid species observed in the areas of studies included *Anomola albopilosa*, *Holotrichia serrata*, *Leucopholus lepidophora* and *L. burmeisteri*. Bangalore region supported seven species. Species belonging to sub family Rutelinae and Scranbinae were more predominant than others. Among the rutelinid *Anomola albopilosa* was more abundant (21.34%), followed by the *Melolonthinae Holotrichia serrata* (19.22%). Species specific abundance was noticed in the

different areas of Malanad region. *Leucopholis* sp. was more predominant in the Malanad region (Mudigere, Sringeri, Shimoga, Sirsi, Belgaum and Chikmagalur areas. *Leucopholis burmeisteri* accounted for 70.2%) abundance in Chickmagalur followed by Thirthahalli,/Shivamoga and Sringeri (68%). *Onthophagus auritus* accounted for 46.42% abundance in the Mudigere region (Table 2).

The predominance of *Leucopholis* sp. could be attributed to longitudinal and altitudinal ranges that influence the kind of vegetation and the cropping pattern. The relative abundance patterns may vary within a community through time and among communities in both time and space and the abundance of species are independent of one another [3].

Table 2: Taxonomic composition and relative abundance of species of scarabaeid beetles at various locations in Karnataka.

Location	Scarabaeidae	Sub family	Abundance (%)
Bangalore	*Anomola sp.*	Rutelinae	14.23
	Anomola albopilosa	Rutelinae	21.34
	Exomala pallidipennis	Rutelinae	12.46
	Holotrichia serrata	Melolonthinae	19.22
	Holotrichia serrata	Melolonthinae	19.22
	Onthophagus nuchicornis	Scarabaeinae	18.62
	Protaetia cuprea ignicollis	Cetoninae	14.32
Chintamani	*Phyllopertha horticola*	Scarabaeinae	22.62
	Onthophagus nuchicornis	Scarabaeinae	40.42
Mudigere	*Onthophagus auritus*	Scarabaeinae	46.42
	Onthophagus auritus	Scarabainae	25.52
Sringeri	*Leucopholis lepidophora*	Melolonthinae	66.7
Shivamoga	*Leucopholis lepidophora*	Melolonthinae	68.8
Thirthahalli	*Leucopholis lepidophora*	Melolonthinae	68.8
Belgaum	*Leucopholis. burmeisteri*	Melolonthinae	10.32
Sirsi	*Leucopholis. burmeisteri*	Melolonthinae	65. 3
Chikmagalur	*Leucopholis. burmeisteri*	Melolonthinae	70.2

Diversity indices

During both the years of study, the Malanad region had higher Shannon Wiener diversity Index (2.25 and 2.78) and lower Simpson index (0.79 and 0.72) respectively as shown in Table 3.

Table 3: Abundance and Indices of scrbaeied beetles in the Malanad region.

Years	Abundance	Shannon index	Simpson index
2017	255	2.25	0.79
2018	278	2.73	0.72

DISCUSSION

The results showed predominance belonging to the Melolonthinae and Scarabaeidae subfamily in terms of abundance and species richness. The observations made were in corroboration with the reports of earlier workers Dadmal and Khadakkar, Pathania et al., Aparna, Bhattacharyya et al., and Sreedevi et al. [7-11].

The areas under survey fall under low humid temperate regions 12.57°N-12.97°N and 75.72°E-78.05°E) with an altitude of 2322-2479 MSL had made possible for the diverse scarab fauna in the various habitats. Species richness was reported to be

negatively and significantly correlated with altitude [12-14]. The cropping pattern in the region and the natural vegetation would have played a greater role in the diversity. The prevailing low temperatures at high altitudes that inhibit the growth and development of the beetles may be contributory factor. Occurrence of few species in a community indicates lesser diversity compared to those with high species richness. Dissimilarity in the diversity of beetles across the locations might be due to differences in the altitude, type of vegetation, crops grown and soil [15,16].

CONCLUSION

The present study indicated predominance of beetles belonging to subfamily Melolonthinae with respect to abundance and species richness followed by the subfamily Scarabaeidae.

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