Diversity and Abundance of Coleopteran insects belonging to Family Scarabaeidae, Geotrupidae, Hybosoridae from Nashik, Maharashtra, India

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Abstract: The present coleopteran diversity, abundance and composition of 24 types of dung beetles from Nashik, Maharashtra, India were collected, identified and classified using the Keys described by fauna of British India. These were further authenticated by ZSI, Pune, Maharashtra, India. These documented coleopterans were placed in 14 genera,06 subfamilies and 03 families viz. Scarabaeidae, Geotrupidae and Hybosoridae . Dung beetles were collected using dung baited pitfall traps, light traps and handpicking at five regions belonging to different localities within the study area. Scarabaeinae and Rutelidae were the dominant subfamily belonging to our collection.

Keywords: Coleoptera, Dung Beetles, Diversity, Abundance, Maharashtra

INTRODUCTION

Dung beetles are predominantly available insects variety in tropical woods and savannas[1]. These individual ideally belong to superfamily Scarabaeoidae of the largest insect order Coleoptera. This superfamily comprises of 14 families of which we have beetles belonging to three main families namely Scarabaeidae, Geotrupidae and Hybosoridae . Beetles belonging to Family Scarabieidae are called Dung beetles where as those belonging to Geotrupidae and Hybosoridae are called Earth boring Dung beetles and Scarab beetles respectively. Interestingly these beetles feed upon the microbial rich fluid of mammalian dung and utilize the fibrous material to brood their hatchlings[2,3].

Dung beetles, Earth boring Dung beetles and Scarab are economically important species. Dung beetles also called coprophagus beetles feeding on feces of both large and small mammals. Some of these also feed on the decaying leaves, fruits and mushrooms etc which in one way helps in crucially maintaining the nature’s sanitation. Further their excreta helps in enhancing the fertility of soil[4]. Apart from this the excreta also shields seeds from predation[5,6] of disease-causing organism. Certain phytophagus beetles commonly known as chafers are agricultural pest, plantation and forests[7].In addition some distinctive species destroy woods edges, trees and crop plantation[8,9]. Assortment of elements like fauna, flora, solar radiation, temperature, soil sort, soil pH and above all the supply of fecal matter for sustenance play an important role in distribution of coprophagus beetles in a given range[10].The scarab beetles of the order Coleoptera incorporate both valuable and in addition unsafe insects.

The present study was aimed to report the composition of coleopteran species, species richness and dispersion of abundance.

MATERIAL AND METHODS

1. Sampling of dung beetles

Specimens for the present study were collected from various areas at night by using baited pitfall traps[11] and Light traps[12]. At a time 2-3 specimens were collected .Collected specimens were placed in insect killing jars containing ethyl acetate and then transferred in glass vials containing absolute ethanol. Further these specimens were taken for authentication and all the voucher specimens were deposited in National Zoological Collection of Zoological Survey of India, Pune, Maharashtra (India).

2. Study Area:

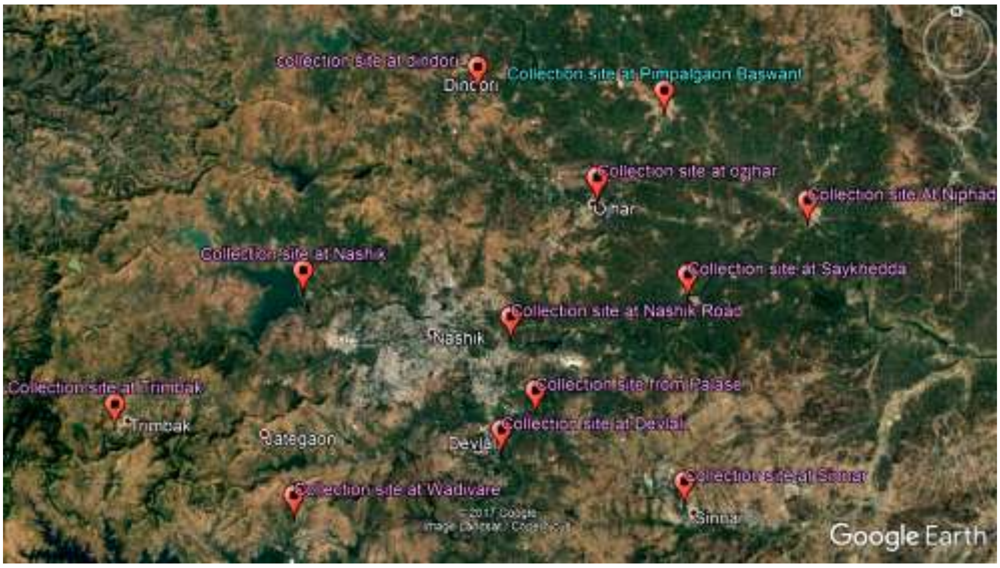

Fig.1: Total Collection site from Nashik (Courtesy: Google Earth)

Specimens for the present study were collected during 2015 to 2017 from 13 localities of Nashik (fig.1) which were divided into total 5 regions and diversity index was calculated.

Table no.1 Collection site from Nashik and Transect Sets

No.	Collection site	Region
1	Dindori	Region I
2	Pimplgaon	
3	Ozhar	
4	Niphad	Region II
5	Saykheda	
6	Nashik raod	Region III
7	Nashik	
8	Goadavri riverside	
9	Palse	Region IV
10	Devlali	
11	Sinnar	
12	Wadivare	Region V
13	Trimbak	

Further, sample based rare fraction and other community composition methods were calculated utilizing Biodiversity Pro programming version 2[14].

3. Data Analysis:

Data was statistically analyzed using α – & β –diversity. Alpha diversity is the diversity of the sites (habitats) within the study area whereas Beta-diversity is the spatial heterogeneity of the diversity defined as Alpha[13].

RESULTS AND DISCUSSION

A. Scarab Beetle Species Composition:

A total of 24 coleopteran species from 3 families, 6 subfamilies were recorded during the present investigation (Table 2). Of these 14 coleopteran insects were identified upto the species level and 10 up to genus level.

Table 2: Total number and percentage of species, genera and individuals observed per subfamily

Subfamily	Genera		Species		Individual	
	No.	%	No.	%	No.	%
Scarabaeinae	6	35.70	6	25.00	42	47.73
Dynastinae	2	14.29	2	8.33	04	4.55
Melolonthinae	2	14.29	2	8.33	11	12.50
Rutelidae	2	14.29	7	29.17	18	20.45
Bolboceratinae	2	14.29	3	12.50	06	6.82
Hybosorinae	1	7.14	4	16.67	07	7.95
(Total) 6	14	100.00	24	100	88	100

Table 3: List of coleopterans recorded in the study area

Family	Sub-Family	Genera	Species
Scarabaeidae	Scarabaeinae	*Heliocopris*	*gigas*
		Onitis	*philemon*
		Catharsius	*molossus*
		Onthophagus	*gazza*
		Onthophagus	*catta*
		Catharsius	*sagax*
	Dynastinae	*Pentodontini*	*sp.*
		Oryctes	*rhinoceros*
	Melolonthinae	*Apogonia*	*sp.*
		Holotrichia	*consanguinea*
	Rutelidae	*Adoretus*	*3 sps.*
		Anomala	*ruficapilla*
		Adoretus	*stolickzae*
		Adoretus	*lasiopygus*
		Adoretus	*kanarensis*
Geotrupidae	Bolboceratinae	*Bolboceras*	*2 sps.*
		Bolbohamatum	*sp.*
Hybosoridae	Hybosorinae	*Hybosorus*	*2 sps*
		Hybosorus	*illigeri*
		Hybosorus	*orientalis*
(Total) 3	6	14	24

Family Scarabaeidae showed prominent species richness and abundance amongst the three. Subfamily Rutelidae and Scarabaeinae belonging to this family was dominant with 7 and 6 species respectively whereas both subfamilies Dynastinae and Melolonthinae were with 2 sp. each *Adoretus* belonging to family Scarabaeidae and subfamily Rutelidae was the richest genera with 6 species. *Anomala ruficapilla* belonging to same subfamily showed presence as a singleton sp.(Table 3).Varied genera were note in subfamily Scarabaeinae.

Family Geotrupidae and Hybosoridae which includes Subfamilies Geotrupinae, Hybosorinae, is represented by only 3 and 4 species respectively.,

B. Species Diversity and Abundance Pattern:

As a measure of diversity in the environment of different regions under investigation Shannon's indices was computed and compared. The Shannon diversity index demonstrated that region IV was relatively diverse (0.657) trailed by region II (0.613), region V (0.561), region I (0.553) and region II (0.553). The Simpson and Shannon J (evenness) indices additionally uncovered more or less the same in order (Table 4).

Table 4: Alpha diversity indices for different regions at Nashik, Maharashtra

Index	Region I	Region II	Region III	Region IV	Region V
Shannon H'	0.553	0.613	0.553	0.657	0.561
Shannon J'	0.711	0.787	0.918	0.94	0.803
Simpsons (D)	0.37	0.282	0.222	0.181	0.308

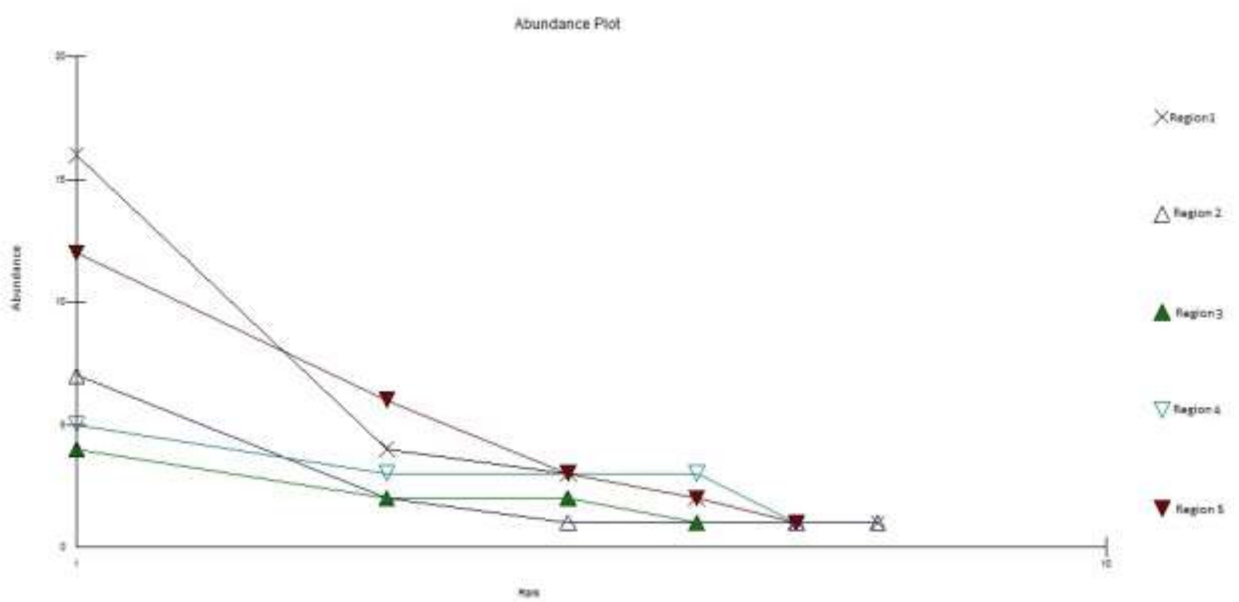

Fig.2: Species rank abundance plot for five different regions

C. Species rank abundance & Sample Based Rarefraction:

Species were positioned by their abundance. Common species are shown on the left and the uncommon species are on the right (Fig. 2). Rarefraction curve is shown in Fig. 3. Expected number of species has been plotted against number of Individuals. This plot gives a measure of species diversity. More extreme curve indicates more diverse communities. Such an extreme curve was seen for region II and IV .Region I was similarly rich to region V. Region III was low in diversity.

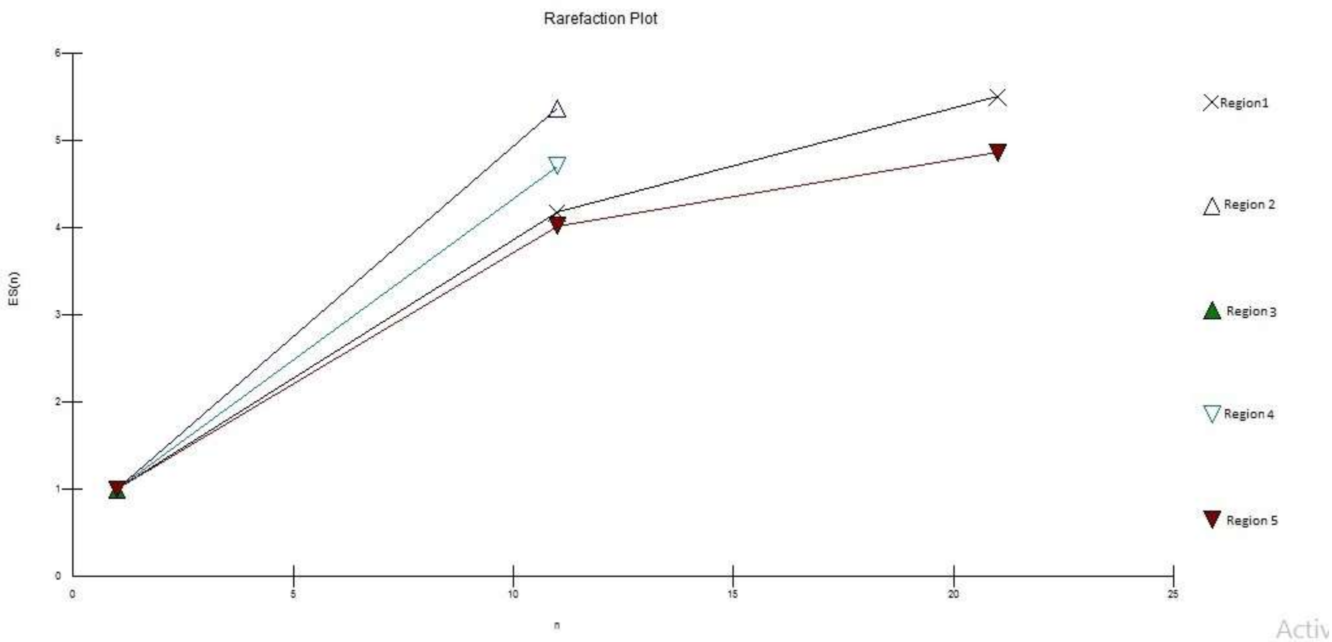

Fig 3: Sample based rarefraction curve for different regions

D. Comparison of Species Turnover among Regions:

To visualize distinction in species composition between the diverse region, Bray Curtis coefficient matrix was established. This helped in understanding the similarity, richness, and abundance of dung bug taxa. The dendrogram clustering of region grouping was drawn (Fig. 4). Region I and region V formed a solitary cluster and rest all region stood separated from each other Overall species arrangement and population structure at region I and V were more contrasted with other regions, Whereas region II, III and IV were different from first group.

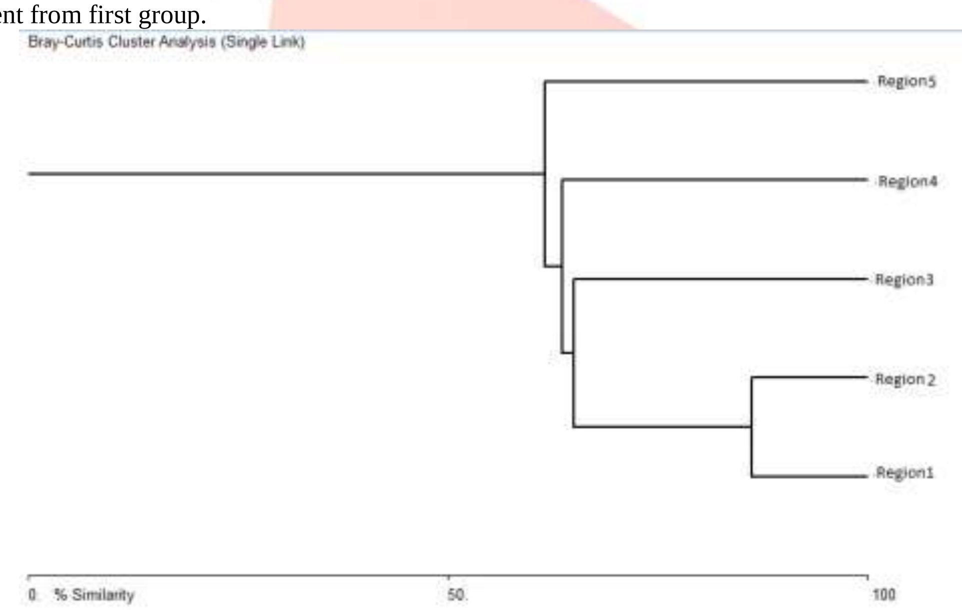

Fig. 4: Dendrogram comparing different regions by their beetle species assemblage

E. Faunal Distribution:

Species distribution of dung beetle fauna in various regions was evaluated. Majority of the species demonstrated random species distribution aside from Scarabaeinae subfamily (Table 5).

Table 5: Distribution profiles of dung beetle fauna at Nashik region

Subfamily	Variance	Mean	Chi-sq	d.f.	Probablity	Aggregation
Scarabaeinae	30.3	8.4	14.4286	4	0.0062148	Aggregated
Dynastinae	4.3	3.6	4.7778	4	0.3104512	Random
Melolonthinae	1.7	2.2	3.0909	4	0.545298	Random
Rutelidae	1.3	1.4	3.7143	4	0.5525796	Random
Bolboceratinae	0.7	1.2	2.3333	4	0.6779598	Random
Hybosorinae	0.2	0.8	1	4	0.9089377	Random

The outcomes showed that the diversity of the dung beetle fauna of Nashik district of was very high (14 genera and 24 species). The coleopteran fauna in the present investigation was dominated by the subfamily Scarabaeinae which includes 47.33 % of the aggregate species, trailed by the Rutelidae (20.45%). Concentrates from show investigation demonstrated greater comparability between region I and V. This comparability was expected to microhabitat and area disturbance. Changes in beetle composition and abundance are straightforwardly identified with ecological changes[15,16]. In addition,the regular Bray Curtis distinguished the peculiarity of ecologically dissimilar habitat because of its lesser abundance. The observed divergence in group organization between region II,III and IV could be because of changeability in soil trademark and vegetation sort from accumulation site of region. The other technique for measuring diversity which was broadly utilized with invertebrate information is the rarefraction strategy[17]. This is a graphical method for communicating diveristy, wherein steep bend demonstrates high diversity and shallow curve shows low diversity. Dung beetle community composition at region II and IV were richer than region I and V. The dung beetle collection at Nashik region were dominated by subfamily Scarabaeinae with uncommon and in addition with bounteous species.

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Plate No.1

(a) Heliocopris gigas,(b) Onitis philemon,(c) Onthophagus gazza,
(d) Onthophagus catta,(e) Oryctes rhinoceros,(f) Pentodontini sp.,
(g) Apogonia sp.,(h) Holotrichia consanguinea,(i) Adoretus sp.

Plate No.2

(j) *Adoretus kanarensis,(k) Adoretus lasiopygus,(l) Adoretus stolickzae,*
(m) Anomala ruficapilla,(n) Adoretus sp.,(o) Bolboceras sp,. (p) Bolboceras sp.,
(q) Bolbohamatum sp. (r) Hybosorus orientalis