

Abundance and diversity of ground beetles (Carabidae) of Ranchi, Jharkhand

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ABSTRACT

Ground beetles are important bioindicators of the habitat and its study helps in insect and weeds management at the farms. A study was carried out in the 2017-2020 to measure the biodiversity and impact of urbanization on the ground beetles. Ground beetles were collected by pit fall, observations and by mechanical methods from four experimental sites - two from urban area and two from the suburban area. The results obtained after running the data on PAST Version 4.03, the Shannon diversity index of the urban area is lower than the suburban area. The percentage of collection of the ground beetles were 25 percent from urban area while, 75 per cent from the suburban area. The result of t-Test and Cochran Q Test also were significant to infer the difference between the two sites - urban and suburban are different.

Key Words - Ground beetles, diversity, species evenness, urbanization, Cochran, Q-test, PAST

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INTRODUCTION

Modern agriculture and land use patterns have led to great changes in the agro-ecosystem globally (Do *et al.*, 2012). Jharkhand is no exception to it, a forest dominated state-about 29.76% of the geographical area of the state is covered with forest (<https://forest.jharkhand.gov.in>) has impact of change due to industrialization and urbanization processes in the last twenty year. Consequences of changed land use pattern has subjected the state in loss of biodiversity of insects.

Ground beetles (Carabids, Coleoptera) are ubiquitous polyphagous predators' insects (Jowett *et al.*, 2019). Their potential to control pest arthropods and weed seeds in crop areas has led to inclusion of management measures to boost carabid abundance on farms (Kromp, 1999). Carabids have the subject of interest and experimental study as their distribution is highly influenced by the change in soil properties (de Vries

et al., 1996; Elek *et al.*, 2010; Hendrickx *et al.*, 2007; Jowett *et al.*, 2019; Keller *et al.*, 2004; Koivula & Vermeulen, 2005; Kushwaha *et al.* 2017; Thiele, 1977). A study was carried out from the year 2017 to 2020 in the urban and suburban area of Ranchi to measure the status of carabids.

MATERIAL & METHODS

Present work was carried out within the Geographical boundaries of Ranchi district of Jharkhand that lies between 23 22' N 85 20'E (Fig.1). Its covers about 175.12 kilometre, and its average elevation is 651m above sea level. It is in the southern part of the Chhota Nagpur plateau of Jharkhand, which is the eastern section of the Deccan plateau in India.

Four experimental stations were setup in the urban and sub urban area. For collecting ground beetles (GB). Observation, pitfall traps and other mechanical methods were applied for collection of

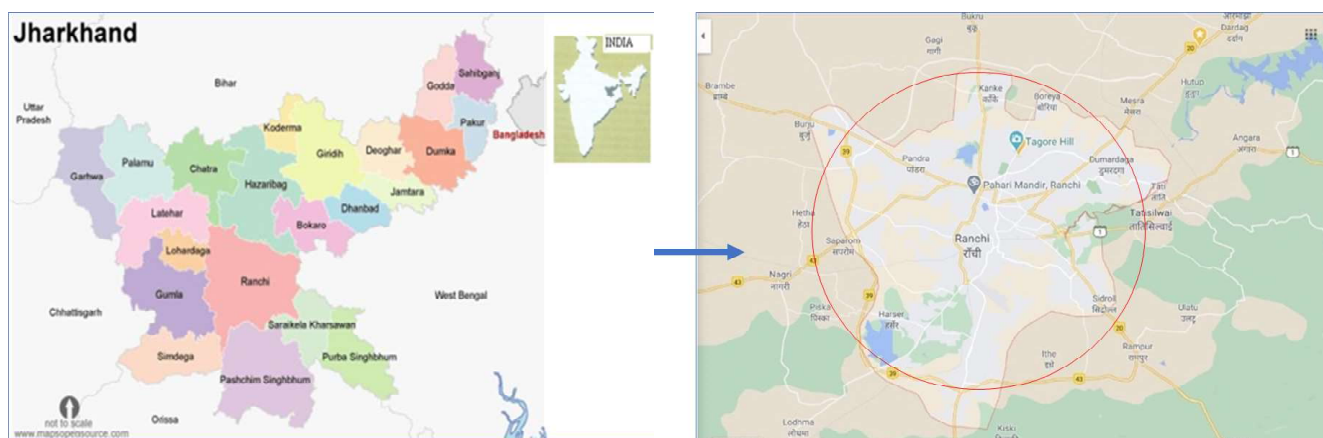


Fig. 1- Location map of study area - shown in circle

GB. The collected specimens were set-pinned, labelled, and identified with help of available literature, recent publications on website. The photographs of the specimens were taken from Nikon D750 with AF-S Micro NIKKOR 40mm 1:2.8G lens and Canon EOS 60D with Canon Macro Lens EF 100mm 1:2.8USM. Statistical analysis was carried on PAST, version 4.03 for Mac (Hammer, 1999) and MS Excel version 15 for Mac.

Community Structure analysis was done applying Shannon & Weaver, 1949 diversity index, H' Max for community evenness and 'J' for species evenness. Two sample unpaired t-Test was run to established the differences between two communities to measure the impact of change in land in use pattern.

Shannon & Weaver, 1949

$$H' = \sum_{i=1}^s p_i \log p_i$$

Where,

p is the portion of the species in the community.

s is the total number of species,

i is the log with base 'e' (Pielou, 1975)

RESULT & DISCUSSION

Total 3825 individual insects were collected during the study period. Out of which 46 ground beetles (GB) were identified, which is presented in table 1. The percentage of collection of the GB is presented in table 1 and fig. 2. It is imperative from table that representation of Carabidae family in the total collection is 5 percent only. It is imperative from

table 2 that the collection of GB is only 25 percent from urban area, collectively, site I and II, whereas the total per cent of GB collectively collected from site III and IV are 31.81 percent and 43.18 percent. Therefore, in the opinion of the authors there is impact of urbanisation on the distribution and diversity of the ground beetles (Hermy & Cornelis, 2000). A check list of the collected ground beetles is presented in the table 3. Fig. 3 shows the collection pattern of the ground beetles.

Table 1- Percent of Ground Beetles collected during the study period

Collection site	No. of Ground Beetles collected in per cent
Urban area (Site I & II)	25.00 %
Sub Urban area (Site III)	31.81%
Suburban area (Site IV)	43.18%

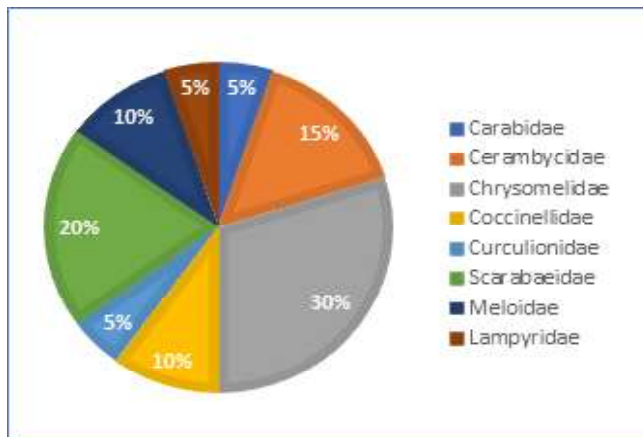


Fig. 2- Family wise distribution of beetles in the study area

Table 2. Check list of Ground beetles collected from the study area during the study period

Sn	Genus/Scientific Name	Family	Collected from (Urban/ Suburban Area) Ranchi	Specimen No.
1	<i>Agelastica</i>	Chrysomelidae	Pithoria/Suburban area	IX/2/ B1
2	<i>Coccinella transversalis</i>	Coccinellidae	Kanke/ Suburban area	II/2/ B1
3	<i>Zygogramma bicolorata</i>	Chrysomelidae	Kanke/ Suburban area	IV/2/B1
4	<i>Luperomorpha vittate</i>	Chrysomelidae	Pithoria/Suburban area	XII/2/B1
5	<i>Brachystylus sayi</i>	Curculionidae	Pithoria/Suburban area	XI/2/B1
6	<i>Podontia</i>	Chrysomelidae	Kanke/ Suburban area	III/1/B1
7	<i>Charidotella sexpunctata</i>	Chrysomelidae	Pithoria/Suburban area	III/6/B1
8	<i>Brachinus</i>	Carabidae	Morabadi/Urban area	I/3/B1
9	<i>Chlorophorus</i>	Cerambycidae	Morabadi/Urban area	I/22/B2
10	<i>Charidotella</i>	Chrysomelidae	Pithoria/Suburban area	IV/19/B2
11	<i>Nemognatha sp.</i>	Meloidae	Pithoria/Suburban area	II/5 & III/5/B1
12	<i>Anoplophora</i>	Cerambycidae	Pithoria/Suburban area	IV/5/B1
13	<i>Onthophagus sp III</i>	Scarabaeidae	Pithoria/Suburban area	I/8 & II/8/B1
14	<i>Leptinotarsa</i>	Chrysomelidae	Kanke/ Suburban area	VII/2/B1
15	<i>Cycloneda sp.</i>	Coccinellidae	Morabadi/Urban area	I/13/B1
16	<i>Photuris sp.</i>	Lampyridae	Pithoria/Suburban area	I/5/B1
17	<i>Titanus sp.</i>	Cerambycidae	Morabadi/Urban area	V/1/B1
18	<i>Trox sp.</i>	Trogidae	Morabadi/Urban area	X/1/B1
19	<i>Luperomorpha sp.</i>	Chrysomelidae	Morabadi/Urban area	I/3/B1
20	<i>Gyronotus sp.</i>	Scarabaeidae	Morabadi/Urban area	I/7/B1
21	<i>Various sp.</i>	Tenebrionidae	Kanke/ Suburban area	VI/1/B1
22	<i>Onthophagus</i>	Scarabaeidae	Pithoria/Suburban area	VI/2/B1
23	<i>Onthophagus sp II</i>	Scarabaeidae	Pithoria/Suburban area	VI/4/B1
24	<i>Mylabris sp.</i>	Meloidae	Pithoria/Suburban area	I/6/B1
25	<i>Anthrenus?</i>	Dermestidae	Kanke/ Suburban area	II/1/B1
26	<i>Anthrenus</i>	Dermestidae	Pithoria/Suburban area	IV/1/B1
27	<i>Centronopus</i>	Tenebrionidae	Pithoria/Suburban area	VIII/1/B1
28	<i>Zygogramma colorata.</i>	Chrysomelidae	Kanke/ Suburban area	III/2/B1
29	<i>Leptinotarsa</i>	Chrysomelidae	Pithoria/Suburban area	I/4/B1
30	<i>Monolepta</i>	Chrysomelidae	Kanke/ Suburban area	I/9/B1
31	<i>Hydrophilus triangularis</i>	Hydrophilidae	Morabadi/Urban area	I/11B1
32	<i>Dicrepidius?</i>	Elateridae	Morabadi/Urban area	II/18/B2
33	<i>Cybister sp.</i>	Dytiscidae	Morabadi/Urban area	I/14/B1
34	<i>Carabusgranulatus</i>	Carabidae	Kanke/ Suburban area	V/2/B1
35	<i>Bolitophagini?</i>	Tenebrionidae	Kanke/ Suburban area	II/6/B1
36	<i>Clivina sp.</i>	Carabidae	Pithoria/Suburban area	XII/13/B1
37	<i>Clivina assamensis</i>	Carabidae	Kanke/ Suburban area	IV/8/B1
38	<i>Oxylobus</i>	Carabidae	Pithoria/Suburban area	XII/5/B1
39	<i>Sparostes striatulus</i>	Carabidae	Pithoria/Suburban area	XII/7/B1
40	<i>Anthia sp.</i>	Carabidae	Kanke/ Suburban area	IV/9/B1
41	<i>Macrochelius</i>	Carabidae	Kanke/ Suburban area	IV/10/B1
42	<i>Siagona</i>	Carabidae	Pithoria/Suburban area	XII/3/B1
43	<i>Colfax</i>	Carabidae	Kanke/ Suburban area	IV/5B1
44	<i>Planetes</i>	Carabidae	Kanke/ Suburban area	1V/7/B1
45	<i>Diplochelia</i>	Carabidae	Kanke/ Suburban area	IV/6/B1
46	<i>Dyschirius</i>	Carabidae	Morabadi/Urban area	1/24/ B2

Table 3- Showing Shannon diversity index - H', Community evenness - Max H' and Species evenness - J' of different sites during study period -2018

Seasons Sites	2018 Summer			2018 Rainy			2018 Winter		
	H'	Max H'	J'	H'	Max H'	J'	H'	Max H'	J'
Site I	1.186	1.230	0.964	1.178	1.255	0.939	1.195	1.230	0.971
Site II	1.296	1.342	0.965	1.221	1.342	0.909	1.230	1.255	0.980
Site III	1.146	1.255	0.913	1.060	1.255	0.845	1.172	1.279	0.916
Site IV	1.155	1.447	0.798	1.014	1.447	0.701	1.228	1.380	0.890

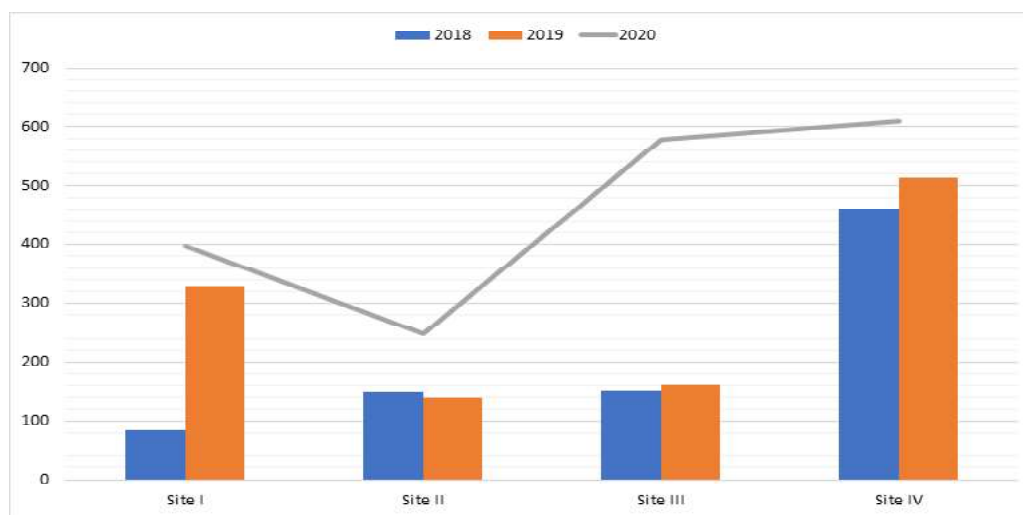


Fig. 3- Collection pattern of the Ground beetles

Table 4- Result of Cochran Test significance converted to percentile for occurrence pattern of Ground beetle in the study area

Site No.	Summer			Rainy			Winter			Occurrence Percentile
	2018	2019	2020	2018	2019	2020	2018	2019	2020	
Site 1	0	0	1	0	1	1	0	0	0	0.75
Site II	1	0	0	1	1	1	0	0	0	0.625
Site III	0	0	0	0	0	1	0	0	0	1
Site IV	1	1	1	0	1	1	1	1	1	0.125

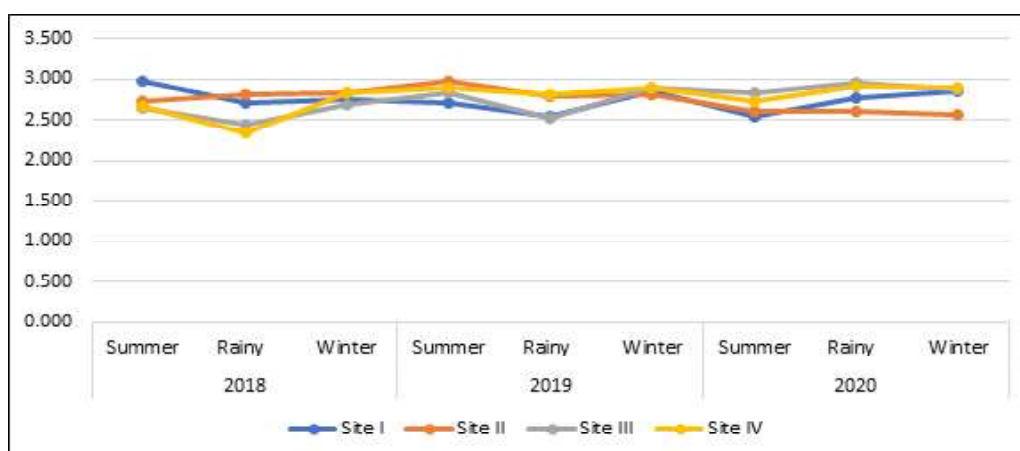


Fig. 4- Season variation in the Shannon Diversity Index of the all four study area

Table 3 shows Shannon diversity index, H' Max - community evenness and 'J'- Species evenness, the students t-Test run for working out the difference of mean, it was observed that the sub urban site III and IV are significantly different from site I and II at confidence level 0.002. Cochran Q-test (Table 4) was carried out for the urban and suburban experimental sites and it was observed that diversity difference in the sites is significant.

CONCLUSION

Conclusively it can be said that there is impact of urbanisation on the abundance and diversity of the ground beetles of Ranchi urban area.

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