



Temporal variation in the community structure of dung beetles (Scarabaeidae: Coleoptera: Insecta) in Kurukshetra, Haryana

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Abstract

As dung beetles play a critical role in recycling the organic matter in nature, the monitoring of dung beetles diversity in different geographical areas has become very important. The present preliminary surveys in Haryana show that the pattern of dung beetles occurrence is already disturbed. A very less abundance and species richness as recorded in these surveys, as compared to earlier studies, is a cause of worrisome. A welcome sign of the present study is the finding of more dung rollers from the protected forest areas. To study the temporal variations of dung beetle abundance and community structure in and around Kurukshetra, surveys were conducted during the season (March-July) at two sites i.e. in village Jhansa and Kirmach. The area chosen for study is mainly used for cultivation and has plenty of cattle dung and small stored dung heaps with trees scattered along the pathways. Dung beetles were collected by baited pitfall traps and also manually. A total of 2152 dung beetles captured, fall under 21 species, 6 genera and three subfamilies. Some of the dominant species were *Onthophagus falsus*, *Digitonthophagus bonasus*, *Onthophagus mopsus*, *Aphodius lividus*, *Digitonthophagus catta*, *Onitis subopacus* and *Aphodius moestus*. In overall comparison to earlier records of dung beetles from the area, a decline in the fauna was recorded. Diversity is found to be affected due to the seasonal changes. The distribution of dung beetle species and abundance is not uniform throughout the study period, the assemblages vary temporally. The overall pattern that we detected indicates that in the organization of dung beetle community, the richness, abundance and diversity rise in the month of July.

Keywords: scarabaeidae, temporal variations, dung beetles, cyclic variation

Introduction

Scarabaeidae constitute the largest family within the Superfamily Scarabaeidae, forming a cosmopolitan group and one of the richest in species number within the order Coleoptera. These beetles are thought to be very valuable to mankind. Coprophagous beetles play an important role for the mankind as they employ million of tons of human and cattle dung into the deeper layers of soil (Hingston, 1923) [23]. The dung beetles respond to environmental changes, so that the community found was never the same all the time. Seasonal factors affect the structure of the community by changing the occurrence and abundance of these beetle and their seasonal and phonological cycles. Davis in 1996 found the seasonal variation in the size and composition of the coprophagous beetle community.

Keeping in view the importance of the dung beetles in ecological studies, it is proposed to make some preliminary investigations on the local dung beetle fauna for its species diversity, species evenness and seasonal abundance temporally.

Methodology

The seasonal activity of adult dung beetles was monitored from March to July in and around Kurukshetra, Haryana state (India), which is situated at 29°58'N latitude and 76°51'E longitude, approximately 250 meters above the sea level.

Topographically it is mostly plain area. The area around Kurukshetra is used for farming purposes, with all types of crops are grown, so there is abundance of farming and domestic cattle which frequent around for foraging grazing and void plenty of dung droppings all around. To study the fauna over large area, two sampling sites I and II were embarked. The site I was located near Jhansa village about 25Km North of Kurukshetra. The land is mainly used for cultivation with trees scattered here and there and along the roads and pathways. The site II was located near the famous holy tank, Braham Sarovar on the Kirmich road. The area has plenty of cattle dung and some small stored dung heaps. Sampling was done by using pit fall bait traps (Tyndal *et al.* 1981) [6]. Five replicates of traps at 5m distance were fixed in the ground by digging the soil so as to keep the upper edge of the traps in the level with the soil surface. On the fixed day of the week the traps were baited in the evening with about 100-150 gm of the fresh cattle dung. After 24 hrs., the traps were emptied of their collection and were closed till the next week. The beetles were identified with the help of the identification keys and description of 'British Indian Fauna' by Arrow (1931) [1].

Data Analysis

All the beetles were identified to the species level and counted, to compare assemblages and constituent of species.

The variation among sites and months was described by parameters that include species richness, monthly changes in assemblages, composition and diversity and analysis of assemblage variability

The species diversity of the area was calculated by Shannon Wiener Index as follows

$$H' = - \sum_{i=1}^R p_i \ln p_i$$

The related index of evenness also was calculated by the formula (Pielou, 1974)

$$E_h = \frac{H}{H_{max}}$$

Dominance was calculated by Simpson Index of dominance as

follows:

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

S = total number of species in the community (richness), i = ith species, and Pi = the proportion of the community (abundance) which belongs to the ith species.

Results and discussion

On pitfall trap at site I total catch of dung beetle was 726 belonging to 18 species, five genera (*Hybosorus*, *Aphodius*, *Onitis*, *Oniticellus* and *Onthophagus*) and three sub families (*Hybosoridae*, *Aphodaenii* and *Scarabaeinae*) given in Table 1. At site II 16 species of four genera (*Aphodius*, *Onitis*, *Oniticellus* and *Onthophagus*) belonging to two sub families (*Aphodaenii* and *Scarabaeniae*) were trapped in catch of 1457 (Table 1). So, the total catch from both of the sites was 2183 (Table 1).

Table 1: Number of species and individuals of dung beetles caught from both collection sites

Species	Jhansa					Kirmich					Total
	March	April	May	June	July	March	April	May	June	July	
<i>Hybosoridae orientalis</i>	0	0	0	0	6	0	0	0	0	0	6
<i>Onthophagus sternalis</i>	0	0	0	1	2	0	0	3	1	4	11
<i>O. ramosellus</i>	0	20	10	13	2	0	0	0	0	0	45
<i>O. mopsus</i>	3	30	35	15	26	1	27	36	82	53	308
<i>O. falsus</i>	4	21	34	65	67	1	19	30	94	57	392
<i>O. dama</i>	0	0	0	0	0	0	0	0	0	30	30
<i>O. quadridentatus</i>	0	0	0	0	0	0	0	0	0	7	7
<i>Aphodius moestus</i>	0	1	9	1	1	22	21	42	15	42	154
<i>A. urostigma</i>	0	5	15	3	0	0	0	0	0	0	23
<i>A. lividus</i>	0	23	10	5	4	55	41	45	6	45	234
<i>A. marginellus</i>	0	0	0	0	28	11	3	3	4	12	61
<i>A. campestris</i>	1	2	0	0	6	0	0	0	8	0	17
<i>A. lisenfeld</i>	0	4	3	0	0	0	0	0	0	0	7
<i>Onitis philemon</i>	3	7	0	3	3	0	0	0	0	59	75
<i>O. virens</i>	0	0	0	0	5	0	0	0	0	0	5
<i>O. subopacus</i>	0	0	12	28	34	0	18	20	24	19	155
<i>Euoniticellus pallipes</i>	0	0	19	0	2	0	1	19	0	33	74
<i>E. pallens</i>	2	0	2	2	1	0	0	1	10	22	40
<i>E. spinipes</i>	0	0	0	0	0	0	0	0	4	6	10
<i>Digitonthophagus bonasus</i>	2	20	35	21	12	5	10	27	86	124	342
<i>D. catta</i>	2	10	5	5	16	1	8	19	31	72	169
Total	17	143	189	162	215	96	148	245	365	603	2183
Species Richness	7	11	12	12	16	7	9	11	12	15	21

Species Diversity was found in the range of 1.19 to 2.46 from both of the sites (Fig. 1). It was compared temporally and spatially. Maximum species diversity (2.46) was found in July

at Site II. But at site I, the maximum value of species diversity (2.35) was found in April. It was lowest at site II in March.

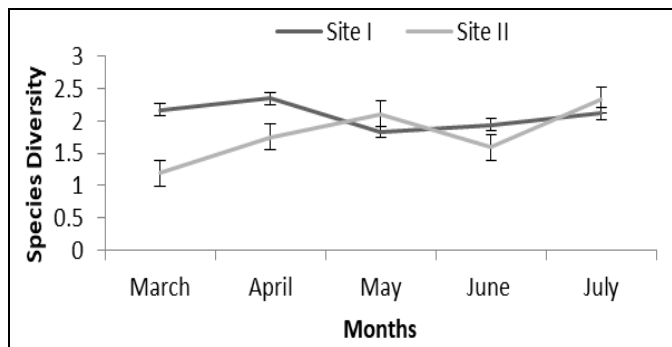


Fig 1: Species diversity at site I and site II

Species evenness was found to be maximum (1.120) at site I and lowest (0.613) at site II in the month of March (Fig. 2). Its value 0.980 at site I in April and 0.880 at site II in May while 0.760 at site I and 0.841 at site II in July within normal range. So, the species were more evenly distributed at site I compare to the site II.

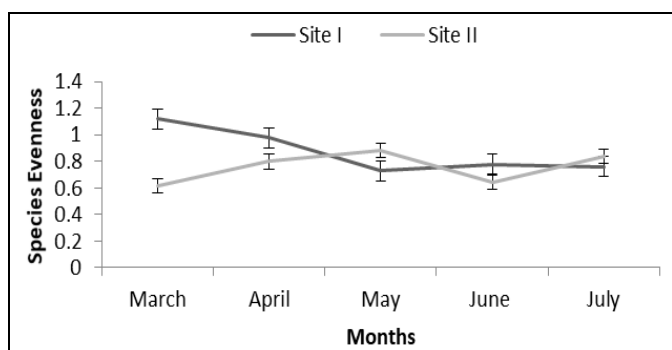


Fig 2: Species evenness at site I and site II

Species dominance was calculated monthly and found to be maximum (0.393) at site II in March, followed by site I (0.310) in the month of June (Fig. 3). The lowest value of species dominance was 0.011 at site II in April. In the month of July less value of species dominance was found as the species were more evenly distributed in this month at site I and site II.

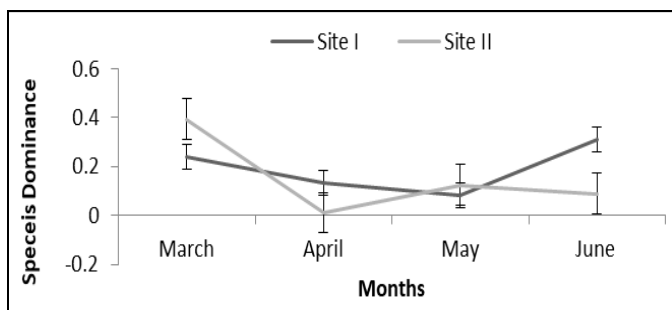


Fig 3: Species dominance at site I and site II

The present study suggests a decline in the population of dung beetles when compared with earlier data of pitfall bait trap by Kaur (1990) Kurukshetra. The decrease in richness and abundance may be due to several factors like use of insecticide spray, treatment of cattle with veterinary drugs

whose residues in dung are toxic to beetles or habitat destruction as the result of urbanization, agriculture practices and industrialization.

Every single environmental factor affects the dung beetles occurrence and abundance. The anthropogenic disturbances to natural system, more around human inhabitations, have affected them and are the main cause for their decline. The loss of their habitat around urban and rural areas and the altered food quality are the major cause for decline of their diversity. The composition of cattle dung food recently has been influenced due to the pollutants (pesticides, fertilizers etc.) in the fodder and veterinary medicines (parasiticides, hormone etc.) given to the cattle which cycle in their system for long and is also a reason for their decline. Although dung beetle volume, abundance, species composition and richness varied by seasons, the declining trends in the occurrence of dung beetles over the years is self evident from the data presented above.

References

1. Arrow GJ. The fauna of British India including Ceylon and Burma, col. Lamella. III (Coprinae), Taylor and Francis, London, 1931, pp428.
2. Davis ALV. Diel and seasonal community dynamics in an assemblage of coprophagous, Afrotropical, dung beetles (Coleoptera: Scarabaeidae s str., Aphodiidae and Staphylinidae: Oxytelinae), J Afr. Zool. 1996; 110:291-308
3. Hingston RWG. 'A naturalist in Hindustan'. H.F. and G. Wtharby London, 1923, 292.
4. Kaur B. Species diversity and seasonal distribution in dung beetles (Scarabaeidae: Coleoptera). M.Phil. Thesis, Kurukshetra University, Kurukshetra, 1990.
5. Pielou EC. Population and community ecology. Gordon and Breach Science Publishers, London, 1974, 424pp.
6. Tyndal-Binscoe M, Wallace MMH, Walker JM. An ecological study of an Australian dung beetle, *Onthophagus granulatus* Boheman (Coleoptera: scarabaeidae), using physiological age grading techniques. Bull. Ent. Res. 1981; 71:137-152.