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Seasonal variation in the population of grassland lady bird beetles of Gaya, Bihar

Neetu Kumari*

Dept. of Zoology, Ranchi University, Ranchi, Jharkhand, India

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Abstract : Co-related with the seasonal fluctuations and sliding threshold of food resources, seasonal variation in time & space (temporal and spatial) in the population of coccimellids commonly called lady bird beetles have been significantly recorded in different grassland habitats of Gaya city area within the radius of 10kms. The paper discusses the rationale of use of statistical information indices that diversity of species particularly of lady bird beetles in grassland habitats covering horticultural gardens of Gaya can be weighed in a way that is similar to the information contained in a genetic code which can also be probed through transcription. The SW-diversity value of five species sampled from Zone-IV (West-North of Gaya) during July 2012 to June 2013 has been quantified alongwith the dominance to the tune of 0.71137 & 4.9326 respectively indicating threatened condition of some species like *Anisolemnia dilatata* (Fab.) and *Axinoscymnus puttarudriahi* (Kapur & Munshi).

Keywords : Seasonal variation, lady bird beetles, grassland habitat, Gaya.

INTRODUCTION

Seasonal variation in the tropical insect population in general is an inevitable phenomenon creating a gradient in there species diversity.¹ This paper is an attempt to calculate this gradient statistically² in order to highlight the seasonal variation in the population of grassland lady bird beetles sampled from urban area of Gaya city.

Starting from agriculture field to the economic crops of vegetables and cereals, varieties of lady bird beetle populations can be easily found thriving on the wide range of floristic leaves & twigs having aphid pest infestation as they are the most branded biological pest control predators.³ Lady bird beetles have been taxonomically regarded as Coccinellids belonging to the order Coleoptera.⁴

Interestingly, the sampling data of six species of lady bird beetles (family Coccinellidae) belonging to different subfamilies when subjected to various statistical information indices, it has given unique picture of monthly species diversity (July 2013- June 2014), relative

abundance, dominance & evenness. On the basis of the statistical results obtained, the patterns of diversity, abundance, dominance & evenness have emerged and the most abundant and rarest species have also been identified in the present study particularly in the quadrats of Zone-II (South-West of Gaya) as followup study programme of the research project.

Understanding the vast unexplored field of sampling of lady bird beetles, the present investigation has been carried out as the follow up step in selected areas of four zones of Gaya.

MATERIALS AND METHODS

In the present investigation, sampling was carried out in the quadrats of Zone II being the South-West sites of Gaya, covering Paharganj, Cantt. area etc.

The land vegetation of the area has been also recorded for the description of physiography of the sampling sites through quadrat method. Zigzag area lying beyond the quadrats were ignored.

Sampling Methods :

Since lady bird beetles are basically of visible size with brilliant colours and less motility, careful hand picking

*Correspondent author :

Mobile : 08084491502

E-mail : neetukumari.315@gmail.com

with the help of glubs and brush were practised as the sampling method. However, All Out Search (AOS) method had also been practised to collect all the representatives of as many as species of lady bird beetles as possible showing visible morphological variations.

Considering the usual habits of these beetles to spend their lives in hidden condition underneath the leaves and barks, such places were also carefully examined during the course of sampling.

Sampling Schedule:

Two hour morning from 7.00 to 9.00 AM and two hour evening from 4.00 to 6.00 PM. sampling schedule were maintained in order to have the best samples. The mid day sampling was avoided because the species were found to disappear during this period. A full day was devoted to each quadrat and attempt was made to collect individuals of all the representatives in the population.

Taxonomic Identification :

The morphologically different individuals were taxinomically identified with the help of Imm's volume II taxonomic key⁷, Lefroy's plates⁸ and the text of Pedriago⁹ for insect classification.

Preservation and Data Collection:

All the individuals of the sample were preserved in 70% alcohol in different vials bearing appropriate tags. The quadrat wise number of sampled individuals according to their genus and species had been recorded in tabular form. (Table1)

Statistical Analysis:

Statistical analysis of numerical collection of data with respect to the sampling of lady bird beetles collected had also been done by using following statistical indices within the habitat :

a) Alpha (á) diversity Shannon Weiner index: -

$$H = -\sum p_i \log p_i$$

Where,

H = α - diversity,

Pi = mean of individual species procured by the formula n_i/N , and $\log p_i$ is the log product of p_i (mean of individual species).

$\log p_i$ = log value conversion of p_i

b) Relative abundance = $n_i/N \times 100$

Where,

N_i = number of individuals of a species.

N = number of individuals of total number of species

c) Evenness = $H/\log_2 S$

Where,

S = number of species , H= diversity.

d) Simpson's dominance $D = 1/D_s$,

$$D_s = \sum_{i=1}^s \frac{n_i(n_i-1)}{N(N-1)}$$

Where,

s= No. of species present

i= ith no.of species (1 to ∞)

n_i = number of individuals of ith species,

N = Total number of individuals of all the species.

OBSERVATIONS

The intensive "all out search" (AOS) sampling of lady bird beetles' in different sites and quadrates of the selected sites of South-West zone of Gaya urban locality has given exciting findings as recorded in the table-1.

Table 1 is the record of six different species of lady bird beetles belonging to one family Coccinellidae and five subfamilies as identified by ZSI, Kolkata as well as confirmed by the various taxonomic keys. The members of sampled individuals were of medium size, except *Coccinella septempunctata* (Linn) and *Axinoscymmus puttarudriahi* (Kapur & Munshi) of sub family coccinellinae which were relatively smaller. The numerical variation of these six species in different months of the sampling year July 2010 to June 2011 ranged in the order- *C.septempunctata* (180) > *A. puttarudriahi* (120) > *A.dialata* (90) > *B. lewisii*(65) > *C. bissellata* (48) > *H. axyridis*(30)- table 1. Accordingly, *C. septempunctata* showed the numerical dominance in all the months of the sampling year while *H. axyridis* remained at the lowest recessive level in this area. The S-W alpha diversity value of these lady bird beetles on the basis of the sampled population of 6 species in different months of the year 2013-14 has been obtained to the tune 0.80235 whereas the dominance value was 3.2856

DISCUSSION

Less significant value of diversity, abundance, dominance and evenness of 6 species of lady bird beetles in the selected locality of Gaya South-West sites (Zone II) has been recorded in the present investigation as the followup research programme on the study of lady bird beetle species diversity of Gaya. The results provide first hand similarities with that of Newzealand lady bird beetle population which is less diverse in species composition as well as population abundance.⁹

Neetu Kumari : Seasonal variation in the population of grassland lady bird beetles of Gaya, Bihar

Although the observation is restricted to a selected locality which prevents from drawing any firm conclusion regarding the possible causes of variation in lady bird beetle diversity from locality to locality of Gaya, Bihar, yet specific trends are quite evident. The first is that man disturbed sites show lower richness and diversity while the undisturbed sites show better population of these species. This is also perhaps related with monoculture plantation like specific herbs of *Parthenium* around which the particular beetle species, *C.septempunctata* (Linn) grew vigorously. The cause of significant reduction in some species richness and diversity in less vegetational area of this zone has been due to the slashing and burning the trees & herbs. The polyculture planted area like orchid and grassy land could also support much population build up of various lady bird beetle species. Some of the species however belonging to Coccinellinae subfamily are insectivorous while some belonging to the subfamilies

Anisolemninae, Bothrocalvinae, Coelophorinae and Hormoninae are phytophagous.

Withstanding to the above facts and also assessed by the values of alpha diversity “Shannon Weiner” index, relative abundance, evenness calculated statistically under statistical information indices,¹ the varieties of lady bird beetles species sampled in this study has clearly established the relative abundance of *C.septempunctata* at 33.71% amongst all the remaining species and hence make it a dominant member in the locality.

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Table 1 : Sampling data and Statistical information indices (S-W alpha diversity- H, Relative abundance - RA, Dominance-D and Evenness-E) of lady bird beetles population sampled from South-West zone of Gaya, Bihar (2013-2014).

Sl. No.	Name of the species of lady bird beetles	Sub family	No. of individuals collected	pi	logpi	S-W Alpha Diversity (H)	Relative Abundance (RA=pi x100)	Dominance (D=1/DS)	Evenness (E)
1	<i>Anisolemina dialata</i> (Fabricius)	Anisolemninae	90	0.16885	-0.77248	0.80235	16.886	3.2856	0.00865
2	<i>Bothrocalvia lewisii</i> (Crotch)	Bothrocalvinae	65	0.12195	-0.91381		12.195		0.00345
3	<i>Coccinella septempunctata</i> (Linn.)	Coccinellinae	180	0.33771	-0.47145		33.771		0.00229
4	<i>Coelophora bissellata</i> (Mulsant)	Coelophorinae	48	0.09005	-1.04549		9.006		0.00465
5	<i>Hormonia axyridis</i> (Pallas)	Hormoninae	30	0.05628	-1.24961		5.629		0.00502
6	<i>Axinosecymus puttardriahi</i> (Kapur & Munshi)	Coccinellinae	120	0.22514	-0.64755		22.514		0.00316
		Total	533						

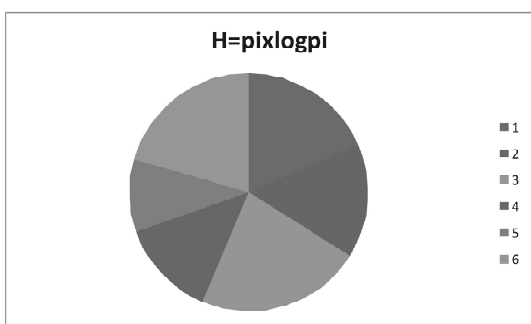


Fig-1: Pie Chart of Species diversity of six lady bird beetle species of South-West zone of Gaya (2013-2014)

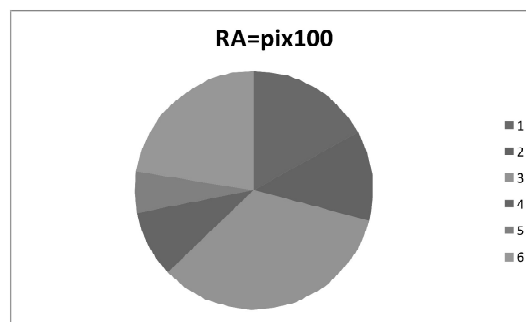


Fig-2 : Pie Chart of Relative abundance of six lady bird beetle species of South-West zone of Gaya (2013-2014)

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