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Observation and Seasonal Variation of Lady Bird Beetle (Coleoptera: Coccinellidae)

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Abstract: *The Coccinellids, which are commonly called as lady bird beetles belong to the family Coccinellidae of the order Coleoptera. The year was divided into three season viz., summer, monsoon, winter and the diversity was calculated for each season in all the study sites. The highest seasonal diversity was observed during winter season in all the study sites followed by monsoon and summer season.*

Keywords: Ladybird beetle, Seasonal effect, Coleoptera, Coccinellidae

I. INTRODUCTION

The family Coccinellidae of the insect order Coleoptera comprises six subfamilies, namely, Chilocorinae, Coccidulinae, Scymninae, Coccinellinae, Sticholotidinae, and Epilachninae (Nedved and Kovář, 2012). A survey was conducted in four sites of Nashik district to study the diversity of the lady bird beetles a total of 14 species belonging to 11 genera and 4 subfamilies were recorded from the area studied (Shaikh and Dugaje2020) .Lady bird beetle are holometabolous insects and possess five stages in their life cycle i.e., egg, larva, prepupa, pupa, and adult, there are three molting and four larval instars.Temperature is the most climactericfactor affecting ecological, functional, and behavioural attributes of predaceous ladybirds. It sets the thresholds of biological activity in form of low and high temperature limits. The developmental rate (DR) is zero at lower development threshold (LDT), which increases with temperature, reaches high thermal threshold, and then decreases rapidly as the peak value is achieved. In ladybirds with similar dietary habits, not much lower development threshold variation occurs and this is also a reason for its successful establishment in different habitats and countries (Nedved and Honek, 2012). Both ladybirds and their prey have different thermal thresholds and an effective temperature range for survival, development, reproduction, and mobility. These thresholds, like LDT, DR, and sum of effective temperature (SET) in day degrees are considered as thermal constants (Jarošík et al., 2011). LDT and SET being thermal constants may estimate the intrinsic rate of increase and generation time of the ladybirds as the development is fastest if the LDT is high and SET is low. Thus, between these two thermal constants there is a negative relationship and the negative slope may be a result of biological variation. However, Jarošík et al. (2014) found these thermal constants may also be considered as diet-dependent variables in aphidophagous ladybirds and therefore questioned whether thermal constants are constant. Temperature also has a significant influence on reproduction and demography.

Lightextremely affects ladybird bio attributes, particularly variables like intensity, wavelength, and duration of exposure (photoperiod). Ladybird beetles have a wide range of tolerance limits to these variables. They are primarily diurnal insects and depend on visual cues and presence or absence of light to undergo various essential activities, like mating, pupation, and molting (Mishra and Omkar, 2005). Most ladybird beetles are higher sensitive to light, particularly its photoperiod (Wang et al., 2013; Mishra and Omkar, 2005; Omkar and Pathak, 2006) and wavelength (Omkar et al., 2006; Nalepa, 2013).

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Nashik has typical monsoon climate, with hot, rainy and cold weather seasons. Tropical conditions prevail all over the state, and even the hill stations are not that cold. Dew, frost, hail can also be happened sometimes according to the seasonal weather. Seasons in the whole year are basically divided into three seasons i.e. summer, monsoon & winter.

II. Material and Material

The behavior of insects can be observed most easily in their natural environments (Schauff, 2004). For scientific documentation of the lady bird beetle fauna from Nashik; efforts have been taken by repeated visiting in the selected sites for collection of voucher ladybird beetle specimens using various collection methods. The visits were mainly arranged twice or thrice in week during early morning and evening time. During the study of considering, the area of Sanctuary rules of forest authorities and habitat type the study area was divided into four sampling sites such as Agriculture (A), Grassland (G), Forest (F), and Human Habitat (H).

Table 1: Sampling Area and collection site of Nashik District

Site	No. of site	Survey site
Agriculture	03	Satana, Deola, Kalwan
Forest	05	Trambak, Igatpuri, Surgana, Dindori, Peth
Grassland	04	Yeola, Chandwad, Nandgaon, Niphad
Humanhabitat	03	Nashik, Sinner, Malegaon

1) C. transversal

2) C.Septempunctata

3) Micraspis discolor

4) Hippodamia convergens

The data were statistically analysed by standard methodological "Analysis of Variance (ANOVA)

III. Results and Discussion

The year was divided into three season viz., summer, monsoon, winter and the diversity was calculated for each season in all the study sites. The highest seasonal diversity was observed during winter season in all the study sites followed by monsoon and summer season (Table 1). The results obtained for seasonality for one year since February 2015 to January 2016 are presented in (Fig. 1).

Table 2: Seasonal abundance of Ladybird beetle Population at Various habitat of Nashik District for the year February 2015-January 2016.

Sampling Site	Summer	Monsoon	Winter
Agriculture	145	970	1590
Grassland	279	1319	2476
Forest	367	1751	2881
Humanhabitat	207	795	1397
Total	998	4835	8344

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Figure1: Seasonal abundance of lady bird beetle Population at Various habitat of Nashik District for the year February 2015-January 2016.

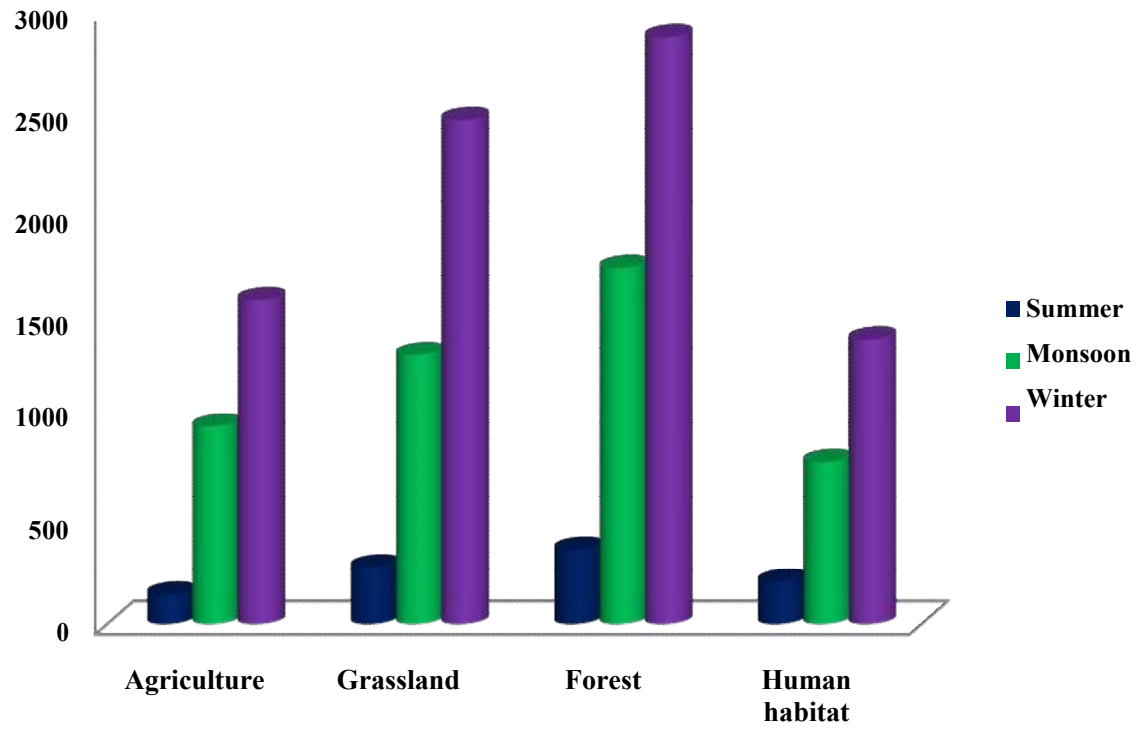

Table 3: ANOVA for Summer 2015-16

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	Value of variance Ratio(F)	Calculated F value
Site	4-1=3	12551	4183.7619	30.707	11.269
Species	14-1=13	19961	1535.4396	11.269	-
Error	56-13-3=39	5313.7	136.24908	-	-
Total	56-1=55	37825.7	-	-	-

For Above table F calculated is greater than F table value. So we Reject H_0 at 5% los. There is a significant difference.

Table 4: ANOVA for Monsoon 2015-16

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	Value of variance Ratio (F)	Calculated F value
Site	4-1=3	38170.054	12723.4	23.2502	29.808
Species	14-1=13	212056.3	16312	29.808	-
Error	56-13-3=39	21342.196	547.236	-	-
Total	56-1=55	271568.6	-	-	-

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Table 5: ANOVA for Winter 2015-16

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	Value of variance Ratio (F)	Calculated F value
Site	4-1=3	96982	32327.33	22.94784	35.67144
Species	14-1=13	653268.9	50251.46	35.67144	-
Error	56-13-3=39	54940.5	1408.731	-	-
Total	56-1=55	805191.428	-	-	-

The year was divided into three season viz., summer, monsoon, winter and the diversity was calculated for each season in all the study sites. The highest seasonal diversity was observed during winter season in all the study sites followed by monsoon and summer season (Table 2) The results obtained for seasonality for one year since February 2015 to January 2016 are presented in (Fig.1). However, few report are available on the variation with the change in the plant characteristics (Honek and Martinková, 2005; Yano, 2006 and Hodek and Michaud, 2008). M. Kashif Zahoor et.al, (2003) a slight fluctuation in monthly collected population was attributed to the ecological conditions. The ecological conditions i.e. the monsoon season and the rapid growth of plants (Coley & Aide, 1991), habitat quality (Rice & Riley, 2000) and climatic factors (Didham et al., 1998; Vulinec, 2000) caused the dispersal of insects within this agro-forest area. The random collection methods also considered for this fluctuation (Kikkawa, 1996)

V. CONCLUSION

The highest seasonal diversity was observed during winter season in all the study sites followed by monsoon and summer season during the study period. It may thus be concluded that Nashik district is rich in coccinellids diversity with forest contributing the most species.

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