



Species Diversity, Richness and Evenness of Ladybird beetles from selected agricultural ecosystems of Sivakasi, Tamil Nadu, India

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ABSTRACT

Survey was conducted on the ladybird beetles in the selected agricultural ecosystems of Sivakasi, Tamil Nadu, India during March 2018 to February 2019. Diversity indices like Simpson's index, Margalef's index, dominance index and evenness index were used for studying diversity and abundance of ladybird beetles. The results revealed the 1080 specimens of ladybird beetles were observed in the field, were identified into three subfamilies, 7 species. The diversity indices showed good diversity and rich fauna of coccinellids. The study brought the fact that the coccinellids are evenly distributed throughout the study area.

Keywords: Agricultural ecosystems, diversity indices, ladybird beetles, survey.

INTRODUCTION

Insects represent a dominant component of biodiversity in most terrestrial ecosystems and play a significant role in the ecosystem functioning [1]. Truncing of biodiversity is one of the most important causes leading to environmental degradation. To improve the crop yield by using fertilizers and pesticides resulted in contamination and disturbance in natural ecosystems, ultimately harming biodiversity and community health [2]. Predation may increase the biodiversity of communities by preventing a single species from becoming dominant. It is obvious that predators depend on prey for survival, and this is reflected in predator populations being affected by changes in prey populations. Predators may be put to use in conservation efforts to control introduced species. Besides their use in conservation biology, predators are also important for controlling pests in agriculture. Natural predators are an environmental friendly and sustainable way of reducing damage to crops, and are one alternative to the use of chemical agents such as pesticides [3]. Among predatory insects, coccinellids are one of the most economically important groups and are very widespread in agriculture and forest ecosystems. They solely feed on a number of distantly related phytophagous insect pests of the agriculture and horticultural crops [4]. About 6000 species of Coccinellids, Ladybird beetles, (Coleoptera Coccinellidae) are known worldwide [5]. However, the study by [6], has listed 400 species of Coccinellids from Indian subregion, which includes the erstwhile state of Uttar Pradesh including the Uttarakhand. Coccinellids are also regarded as bio indicators [7] and provide more general information about the ecosystem in which they occur [8]. In recent years, predaceous ladybird beetles have drawn considerable attention as biological control agents, due to their ability to feed on a large number of prey [9]; [10] including aphids, coccids, phytophagous mites, adelgids and aleyrodids [11]. Review of literature reveals that the information on diversity of coccinellid beetles from Virudhunagar district is scanty and no works have been so far reported. Hence, the present work is aimed to carry out diversity surveillance and the objective of the present study was to examine the species diversity, richness, evenness of ladybird beetles in Sivakasi.

MATERIAL AND METHODS

Study sites

All study sites were based at the agricultural ecosystems (Sivakasi, Virudhunagar, Tamil Nadu). Five agricultural ecosystems were chosen: Brinjal field, tomato field, Lemon orchard, bitter gourd field, okra field. Sites were chosen for each of these agricultural ecosystems.

Data collection

Studies on the abundance and distribution of coccinellid species were carried out during March 2018-February 2019. Samples were collected fortnightly, by using random sampling methods and all-out search method. The data were recorded and used for subsequent analysis.

Statistical analyses

The species diversity, richness and evenness were statistically calculated using the SPSS software.

RESULTS

The research study was conducted from March 2018 to February 2019. Table 1 presents the list of coccinellid species captured in this region. A total of 1080 specimens belonging to three subfamilies, seven genera and seven species in the sampling period were collected and identified. The maximum and minimum numbers of species were found in subfamilies coccinellinae and Scymninae respectively. Among genera, *Epilachna* was the most abundant. Both the species *Coccinella transversalis* and *Epilachna vigintioctopunctata* were found in all of the places of sampling. In Table 2 we can find the distribution of species. Among the referred species, *Epilachna vigintioctopunctata* was dominant in total study sites, as it numbered 517 specimens. The single species *E. vigintioctopunctata* made up 47.87 % of all individuals. The second most abundant species was *C. transversalis* (22.13%) and the next *C. sexmaculata* (16.11%). Among the collected species, *Propyleadissecta* showed narrow range of habitat and were captured only in one field. Okra and tomato fields comprised maximum richness (6 species) and brinjal field was recorded second more richness (5 species). Results showed December was found more favourable for the family coccinellidae. Total of 157 individuals belonging to 7 species were recorded in month December. All the other species together showed a more gradual change in abundance with a minimum in early September and maximum in early December. Diversity of Coccinellidae was evaluated on each area and compared with each other. Species diversity, richness, dominance and evenness were calculated through the sampling periods. It was concluded that the diversity indices are not same for the seven areas. Results of indices were shown in table 3. Based on data in table, highest and lowest species diversity were obtained in December 2018 (0.75) and February 2019 (0.37) respectively. Species richness of ladybird beetles in study area were calculated through the sampling periods. Results showed the greatest and least species richness was founded in December 2018 (1.18) and March 2018 (0.23) respectively. The dominance index result showed highest and lowest dominance index in February 2019 (0.63) and December 2019 (0.24) months respectively. Evenness index of species was calculated throughout the sampling period, maximum and minimum value was shown in March 2018 (0.94) and February 2019 (0.63).

DISCUSSION

Previously similar survey of predatory coccinellid beetle showed been conducted by [12] at Kashmir, India. Results given in Table 1 confirmed that the coccinellids are the most important group among orchards and crop field predators in Sivakasi, Tamil Nadu. The important place occupied by species which food preferences. Ladybirds are density dependent predators; their numbers rise as the prey numbers increase [13]. The prey population, thus thereby determines the ladybird beetle population. In the month December high population of pests were found, thus amount of feeding of ladybirds also increased too. The predaceous role of lady beetles benefits from the maintenance of field diversity, which supports the population of prey such as aphids, thrips and mites believes numbers species largely depends on the number of preys. [14] reported 408 specimens of ladybird beetle which belongs to 4 different subfamilies, 9 genera and 12 species in Ankalga Village, Karnataka, India. In the present the subfamily Coccinellinae was the most abundant comprising 5 species belongs to 5 genera this was supported by the results of [14]. The different diversity indices used during present study was similar to that of indices used by [15]. Many of the Predatory ladybird beetles are active throughout the year. Some species may undergo overwintering or aestivation. In the present study it was observed that most of the ladybirds were active in all cropping seasons in the study sites. Border crops and inter crops may provide suitable microclimate, pollens and breeding grounds to ladybird beetles and they help to maintain a good population of these bio-control agents to control the pest population.

Table1. List of ladybird species collected from selected agricultural ecosystems

Family	Subfamily	Genus	Species
Coccinellidae	Coccinellinae	<i>Coccinella</i>	<i>transversalis</i>
		<i>Cheilomenes</i>	<i>sexmaculata</i>
		<i>Illeis</i>	<i>sp.</i>
		<i>Propylea</i>	<i>dissecta</i>
		<i>Anegleis</i>	<i>cardoni</i>
	Scymninae	<i>Cryptogonus</i>	<i>orbiculus</i>
	Epilachninae	<i>Epilachna</i>	<i>vigintioctopunctata</i>

Table2. Distribution and Total Number of ladybird species collected from selected agricultural ecosystems.

Sampling site Species	Brinjal Field	Tomato field	Bitter guard field	Lemon Orchard	Okra field	Total Number	Percentage of Distribution (%)
<i>Coccinella transversalis</i>	+	+	+	+	+	239	22.13
<i>Cheilomenes sexmaculata</i>	+	+	+	+	+	174	16.11
<i>Illeis sp.</i>	-	+	+	-	+	103	9.54
<i>Propylea dissecta</i>	-	-	-	-	+	17	1.57
<i>Epilachna vigintioctopunctata</i>	+	+	+	+	+	517	47.87
<i>Cryptogonus orbiculus</i>	+	+	-	-	+	12	1.11
<i>Anegleiscardoni</i>	+	+	-	-	-	18	1.67
Total						1080	100%

Table 3: Diversity indices for predatory ladybird beetles in five different crops during March 2018 to February 2019 in Sivakasi.

Biodiversity indices	Mar 2018	Apr 2018	May 2018	June 2018	July 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019
No of Taxa's	2	3	4	4	4	4	6	6	6	7	6	3
No. Of Individuals	68	72	56	55	76	89	113	121	134	157	87	52
Simpson's Index	0.43	0.62	0.66	0.69	0.70	0.68	0.71	0.69	0.71	0.75	0.67	0.37
Margalef's Index	0.234	0.47	0.75	0.75	0.69	0.66	1.06	1.00	1.02	1.18	1.12	0.50
Dominance	0.56	0.38	0.34	0.30	0.29	0.31	0.28	0.30	0.29	0.24	0.33	0.63
Evenness	0.94	0.93	0.80	0.90	0.91	0.87	0.71	0.67	0.69	0.69	0.67	0.63

CONCLUSION

The present study clearly shows the many of the ladybird population are active throughout the year. This may be useful to conserve predatory ladybird beetles in agroecosystems which may lead to natural biological control.

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CONFLICT OF INTEREST

The authors have no conflict of interest.

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