

Population Dynamics of Ladybird Beetle in Different Agricultural Environments of Sattur in Relation to Weather Factors

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Abstract: Population dynamics of ladybird beetle was studied during June 2018- March 2019 in different agricultural fields of Sattur. The ladybird beetle specimens were randomly collected, identified, counted and released again to the field itself. A total of 7 species belonging to 4 subfamilies were identified in selected study area. Of these 4 subfamilies, subfamily Coccinellinae were present in huge amount. During the study period maximum number of ladybird beetles were recorded during the November 2018 and minimum number of ladybird beetles were recorded during March 2019. Monthly variation in relative abundance of ladybird beetles population also noted. Various diversity indices were recorded and correlation co-efficient studies were carried out between ladybird beetle diversity and weather parameters.

Keywords: Ladybird beetle, diversity, relative abundance, diversity indices, correlation coefficient.

1. INTRODUCTION:

Coccinellidae is an significant family in the order Coleoptera. Coccinellid beetles are commonly called as 'ladybird beetles' and majority of the ladybird beetles are predaceous. About 6000 species of Coccinellids, Ladybird beetles, (Coleoptera Coccinellidae) are known worldwide (Vandenberg, 2002). They are of immense economic importance as predators equally in their larval and adult stages on diverse important crop pests such as aphids, coccids and other soft bodied insects. The coccinellidae are an important group of beetles from both an economic perspective in their use as biological control agent and in their diversity and adaptation to a number of differing habitats. The coccinellid beetles are considered to be of a great economic importance in agro-ecosystems appreciation to their flourishing employment in biological control of many injurious insects. So, it's indispensable to maintain their population in agricultural environment for better pest control of agricultural crops. The present study was first of its kind to be carried out in the agricultural environments of Sattur, Virudhunagar District. Many researchers have studied the biology, prey record and distribution of coccinellid beetles in India and such studies in agroecosystems are very limited in Tamil Nadu. In the present study the assemblages of coccinellid beetles in various agricultural environments are reported and the biodiversity of ladybird beetles was correlated with weather parameters.

2. MATERIALS AND METHODS:

The study area Sattur is located between longitude 9.37 ° N, latitude 77.93 ° E, with an elevation of 56 meters (183 feet). The study was conducted in the months of June 2018 through March 2019. Different crop fiends like lemon, sapota, rice, corn, brinjal, rose periwinkle fields spreading over an area of 2ha on each site were selected for sampling. Samples were collected fortnightly, the

coccinellids include immature insects and their adults present on the crops and weed were collected by hand picking method. The specimens were preserved in 70% ethanol and brought to the lab for identification. The specimens were identified using already available literature. Statistical analysis was conducted to determine diversity, richness, evenness, abundance and Correlation coefficient using the software PAST.

3. RESULT AND DISCUSSION:

A total of 1033 specimens belonging to four different subfamilies, 6 genera and 7 species were captured throughout the study period. The subfamily Coccinellinae was the most abundant subfamily comprised of 5 species belonging to 4 genera. Among the three subfamilies, Epilachninae which is represented by only one species namely *Epilachna vigintioctopunctata*(457) was most abundantly present in the study area *C. transversalis*(203) and *Cheilomenes sexmaculata*(174) were most abundant among the coccinellinae subfamily. *C. septempunctata*(7) were present in less number among the Coccinellinae subfamily. The subfamily Epilachninae and Scymninae were each represented by single species (Table 1) . Previously similar survey of Coccinellid beetles diversity in agro-clinatic zones of Bhubaneswar was carried out by Kumar and Suman,(2017). Abbas *et al.*, (2013) reported 2204 specimens belonging to four different subfamilies, nine genera and 12 species in cropland of Faisalabad District. Leather *et al.*, (1999) recorded 371 specimens of 5 species in non-crop habitats of Silwood Park Field Station (England). The Family Coccinellidae was found fluctuating throughout the sampling period. November and December were found more favourable for the family Coccinellidae with 150 and 140 specimens respectively to the total data. The subfamily Coccinellinae and Epilachninae were found most abundantly on these months than Scymninae species (Table 2). Previously

Abbas *et al.*, (2013) reported that the Coccinellidae species were most abundantly present in the month of March in cropland of Faisalabad District. Similarly, Subba and Ghosh (2016) reported higher population of Coccinellidae were recorded in the months of February and March in Tomato field in instructional farm of Uttar Banga krishi Viswavidyalaya at Pundibari, Coochbehar, West Bengal. Species richness (Margalef's index) was high during the month of February (1.155). The margalef's index was ranged between 0.79 – 0.15. The lowest species richness was found during the month of November (0.798) and highest value during the month of February (1.155). This point out that the species richness was slightly high during February. Likewise the evaluated value for species evenness ranged from 0.67 to 0.92 and the calculated value of Shannon - Wiener index was ranged between 0.6-1.5. The lowest diversity index was calculated in the months of January (0.671) and February (0.716). The highest value was found in the months of June (1.569) and October (1.553) (Table 3). The data calculated by the Shannon Wiener index revealed that coccinellid beetles are more or less equally distributed at all months in different agricultural fields because the calculated values did not show much difference among the samplind period. The species richness was maximum at Shorab was given in the earlier report by Biranvand *et al.*, (2014) in Lorestan Province, Iran. Anbalagan *et al.*, (2013) reported species richness was similar in all crops, evenness and the Shannon index were high in okra than in the other crops. Population dynamics of Ladybird beetle shows negative correlation with the minimum and

maximum temperature, -0.301 and -0.437 respectively (Table 4), which means when the temperature increases the ladybird beetle population suffers and decreases in number. Population of ladybird beetle gives positive correlation with rainfall (0.019) (Table 4), that means when rainfall occurs the favourable condition for ladybird beetle arises then the beetle increases in numbers . Previously Subba and Ghosh, (2016) recorded that non-significant negative correlation on ladybird beetle diversity with temperature and non-significant positive correlation with rainfall and relative humidity and gives that this indicates that activity of ladybird population decrease with the rise of temperature, rainfall and relative humidity.

4. CONCLUSION:

The main objective of the study was the population dynamics of ladybird beetles in agricultural environments in relation to weather factors was studied. From the relative abundance, species richenss, evenness index, Shannon index it was concluded that there is more or less similar diversity was occur throughout the study period. When focus on correlation coefficient this clearly indicates that increase in rainfall and temperature affects the ladybird beetle population in the study area.

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Table 1: Ladybird beetles (Coleoptera: Coccinellidae) found in different agricultural fields of Sattur throughout the study period

Family	Subfamily	Species	Total
Coccinellidae	Coccinellinae	<i>Coccinella transversalis</i> (Fabricius)	203
		<i>Coccinella septempunctata</i>	7
		<i>Cheilomenes sexmaculata</i> (Fabricius)	174
		<i>Illeis sp.</i> ,	61
		<i>Propylea dissecta</i> (Mulsant)	39
	Epilachninae	<i>Epilachna vigintioctopunctata</i>	457
	Scymninae	<i>Cryptogonus orbiculus</i>	92
Total	3	7	1033

Table 2: Monthly variation in relative abundance(%) of ladybird beetles (Coleoptera: Coccinellidae) Collected from June 2018 to March 2019

	June 2018	July 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Total
Coccinellinae	45.45	42.57	49.04	44.23	51.13	49.33	36.42	55.13	55.26	44.07	46.85
<i>Coccinella transversalis</i>	13.64	22.77	20.19	30.77	13.54	20.00	12.86	32.05	21.05	13.55	19.65
<i>Coccinella septempunctata</i>	-	-	-	-	-	-	-	-	5.26	5.08	0.68
<i>Cheilomenes</i>	19.31	12.87	20.19	11.54	21.80	24.00	9.29	12.82	17.11	16.95	16.84

<i>sexmaculata</i>											
<i>Illeis sp.</i> ,	4.54	6.93	8.65	1.92	2.26	5.33	7.14	8.97	7.89	8.47	5.90
<i>Propylea dissecta</i>	7.95	-	-	-	13.54	-	7.14	1.28	3.95	-	3.78
<i>Epilachninae</i>	40.91	41.58	33.65	46.15	39.10	43.33	55.00	44.87	44.74	55.93	44.24
<i>Epilachna vigintioctopunctata</i>	40.91	41.58	33.65	46.15	39.10	43.33	55.00	44.87	44.74	55.93	44.24
<i>Scymninae</i>	13.64	15.84	17.31	9.62	9.77	7.33	8.57	-	-	-	8.91
<i>Cryptogonus orbiculus</i>	13.64	15.84	17.31	9.62	9.77	7.33	8.57	-	-	-	8.91
Total	8.52	9.78	10.07	10.07	12.88	14.52	13.55	7.55	7.36	5.71	1033

Table 3: Species richness, Evenness, Shanon diversity indices of Coccinellids on different agricultural fields

	June 2018	July 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019
Species richness	1.117	0.867	0.861	0.861	1.022	0.798	1.012	0.918	1.155	0.981
Evenness	0.799	0.846	0.922	0.712	0.788	0.791	0.676	0.705	0.727	0.703
Shanon diversity index	1.569	1.443	1.528	1.27	1.553	1.375	1.401	0.671	0.716	1.257

Table 4 : Correlation coefficient of ladybird beetle population with weather parameters

Weather Parameters		Correlation coefficient (r)
Temperature (°C)	Maximum	-0.301
	Minimum	-0.437
Rainfall (mm)	Monthly	0.019

REFERENCES:

- [1] Abbas, M.A., S. Kausar and S. A. Rana, 2013. Diversity and distribution of Ladybird beetles (Coccinellidae) in the cropland of Faisalabad District. International journal of advanced research,1(1):27-33.
- [2] Anbalagan. V., M.G. Paulraj and S. Ignacimuthu., 2013. Biodiversity of predatory ladybird beetles (Coleoptera: Coccinellidae) in four different crops in north-eastern Districts of Tamil Nadu, India. International journal of advanced life sciences, 6(5):434-439.
- [3] Biranvand, A., R. Jafari and M. Z. Khormizi, 2014. Diversity and distribution of Coccinellidae (Coleoptera) in Lorestan Province, Iran. Biodiversity Journal, 5(1):3-8.
- [4] Kumar Mukharjee .S and S. S. Suman, 2017.Coccinellid beetles diversity in agro-climatic zones of Bhubaneshwar. Journal of Entomology and Zoological studies, 5(4):1244-1248.
- [5] Leather. R., C. A. Cooke., D.E. Fellowes and R. Rombe, 1999. Distribution and abundance of ladybirds (Coleoptera: Coccinellidae) in non-crop habitats. European Journal of Entomology,96:23-27.
- [6] Subba, B and S.K. Ghosh, 2016. Population dynamics os ladybird beetle and spiders in relation to weather factors in Tomato (*Lycopersicon esculentum* L.). Life sciences international research journal,3(1):35-37.
- [7] Vandenberg N.J., 2002. Coccinellidae Latreille 1807. In: Arnett R.H. Jr., Thomas M.C., Skelley P.E. & Frank J.H., 2002. American Beetles. Volume 2. Polyphaga: Scarabaeoidea trough Curculionoidea. CRC Press, Boca Raton, pp. 371–389.