



Species richness and abundance of Coccinellids (Coleoptera: Coccinellidae) in agricultural ecosystem of Doiwala region, Dehradun (U.K), India

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ARTICLE INFO	ABSTRACT
<p>Received : 02 January 2022 Revised : 03 March 2022 Accepted : 11 March 2022</p> <p>Available online: 23 May 2022</p> <p>Key Words: Biocontrol Agents Community Structure Diversity Ladybird Beetles Predator</p>	<p>Present study was carried out to know the community structure of coccinellid beetles (Coleoptera: Coccinellidae) in agricultural ecosystem of Doiwala region, Dehradun (U.K.), India during January 2021 to December 2021. During the study period, a total of 8 species of ladybird beetles, which belong to 7 genera under 1 family, 3 subfamilies and 3 tribes were recorded, viz., <i>Brumoides suturalis</i> (Fabricius), <i>Coccinella septempunctata</i> (Linn.), <i>Coccinella transversalis</i> (Fab.), <i>Cheilomenes sexmaculata</i> (Fab.), <i>Hippodamia variegata</i> (Goeze), <i>Harmonia dimidiata</i> (Fabr.), <i>Oenopia sauzeti</i> (Mulsant) and <i>Henosepilachna vigintioctopunctata</i> (Li). Out of these eight species, seven were predatory and one was phytophagous. The only phytophagous species was <i>H. vigintioctopunctata</i> (Li). Maximum species of coccinellids were collected from site-3 (7 species), then followed by site-4 (6 species), site-1 and site-2 (5 species each).</p>

Introduction

Coccinellids are predatory and phytophagous in nature and belong to family Coccinellidae of order Coleoptera. Coccinellidae is distributed worldwide and classified into 06 subfamilies: Coccinellinae, Scymninae, Coccidulinae, Chilocorinae, Sticholotidinae and Epilachninae (Vandenberg, 2002). The coccinellids are small in size with an oval, oblong or hemispherical body shape (Majerus, 1994). Most species of coccinellid beetles are an important biocontrol agent of pests such as thrips, aphids, mealybugs, scale insects, coccids, adelgids, aleyrodids and mites (Sharma *et al.*, 2021). The family Coccinellidae is composed of 5,200 described species throughout the world. Fleming (2000) described 4,000 species of predatory coccinellids including more than 300 species from India and Pakistan. Saeed *et al.* (2016) reported 13 species of ladybeetles belong to 11 genera and 3 subfamilies from district Buner, Khyber

Pakhtunwa-Pakistan. Ahmad *et al.*, (2017) reported 9 species from district Sargodha, Pakistan. Dorji *et al.* (2019) reported 91 species of coccinellids and out of them 17 were recorded for the first time from Bhutan. Poorani (2002) have described 400 species of ladybird beetles from Indian subregion. Joshi and Sharma (2008) have recorded 31 species of coccinellid beetles from district Haridwar and out of these, 19 species of coccinellids were reported for the first time from the district Haridwar, (U.K.), India. Joshi *et al.* (2010) have reported 21 species of coccinellids from Pauri-Garhwal district (Uttarakhand), India. Sharma *et al.*, (2014) have observed the feeding potential of *Coccinella septempunctata* Linn. on cowpea aphid, *Aphis craccivora* Koch. Harit (2015) reported 13 species (9 predatory and 4 polyphagous) of coccinellids from Champhai district of Mizoram state (North East India). Sharma (2016) have described the life-

cycle of a predatory ladybird beetle *Coccinella transversalis* (Fabr.). Sharma *et al.*, (2017) reported 65 species from Himachal Pradesh. Sharma and Joshi (2019) have described the detailed morphological and taxonomical descriptions of two coccinellid beetles *Micraspis discolor* (Fabr.) and *Micraspis vincta* (Gorham) recorded from Haridwar district, (Uttarakhand), India. Das *et al.* (2020) have reported 44 species of coccinellids that belong to 22 genera and 6 tribes from Arunachal Pradesh, East Himalaya, India. Sharma *et al.* (2021) reported 9 species of coccinellids from district Sambhal (U.P.). The coccinellids fauna of the Indian subcontinent is diverse and rich, but scanty studied by scientists as compared to those from other continents of the world. The objective of present study was to know the species richness and abundance of ladybird beetles in agriculture ecosystem of Doiwala Block, Dehradun (U.K.), India.

Material and Methods

Study Area

Present study was conducted in and around Doiwala region of Dehradun District (U.K.). The Climate of the district is temperate and varies from tropical to severe cold throughout the year. The study area shows three distinct seasons winter, summer and monsoon. Paddy is the important kharif crops. Wheat is the main crop of rabi and is grown in all parts of the study area. Sugarcane, Rice and mustard are other important crops. Present study was conducted at four different study sites having agricultural field (Table-1).

Sampling of Coccinellid beetles

Sampling of insects was conducted at an interval of 30 days during January 2021 to December 2021. Coccinellids were collected by visual hand-picking method. The study area is divided in 4 sites. Each site was divided and studied into a quadrat of 10x10m. Random sampling was done at a fix interval of 30 days.

Taxonomic Study of Coccinellid beetles

The insects were collected into plastic medium sized vials and then transferred into an insect collecting bottles having ethyl acetate-soaked cotton. After insect collections, these bottles were brought to the laboratory and the coccinellid beetles were taken out from the bottles for stretching and pinning. The entomological pins No.2 were used to

fix the individuals. The coccinellids beetles were dried in oven at 60 °C for three days in order to preserve them. The coccinellids were labelled with paper having all necessary information regarding taxonomic position and then set into insect boxes. The adult specimens of coccinellid beetles were properly studied under binocular microscope. The insects were separated and identified into different genus / species with the help of taxonomic keys of coccinellids.

Results and Discussion

Present study was conducted at four sites, representing agricultural ecosystem of Doiwala region, Dehradun (U.K.), India during January 2021 to December 2021. During the study period, a total of 8 species of ladybird beetles were collected from all four sites.

(A) Vegetational Composition

During the study period, specimens of coccinellids were collected from four sites representing agricultural ecosystem of wheat, mustard, sugarcane, paddy and some other herbs and weeds plants (Table-1). The descriptions of each site are as follows:

Site-1: The site-1 having the agriculture field of Sugarcane (*Saccharum officinarum*) and Loki (*Lagenaria sp.*).

Site-2: The site-2 having the agriculture field of Sugarcane (*Saccharum officinarum*), Loki (*Lagenaria sp.*), Pumpkin (*Cucurbita sp.*), Pigeon pea (*Cajanus cajan*) and Pea (*Pisum sativum*).

Site 3: The site-3 having the agriculture field of wheat (*Triticum vulgare*), mustard (*Brassica campestris* L.), Rice (*Oryza sativa*), Loki (*Lagenaria sp.*) and Pumpkin (*Cucurbita sp.*).

Site 4: The site-4 having the agriculture ecosystem having Wheat (*Triticum vulgare*), Rice (*Oryza sativa*), Mustard (*Brassica campestris* L.), and Loki (*Lagenaria sp.*).

(B) Taxonomic Composition of Ladybird beetles

During the study period, a total of 8 species of ladybird beetles belong to 7 genera under 1 family, 3 subfamilies and 3 tribes were recorded, viz., *Brumoides suturalis* (Fabricius), *Coccinella septempunctata* (Linn.), *Coccinella transversalis* (Fab.), *Cheilomenes sexmaculata* (Fab.), *Hippodamia variegata* (Goeze), *Harmonia dimidiata* (Fabr.), *Oenopia sauzeti* (Mulsant) and *Henosepilachna vigintioctopunctata* (Li). Out of

Table 1: Crops combination of four different sites of Doiwala Block during Jan. to Dec. 2021

SN	Sites	Locations	Crop Combinations of Sites
1.	Site-1	Balawala	Sugarcane and Loki
2.	Site-2	Doiwala	Sugarcane, Loki, pumpkin Pigeon Pea and Pea
3.	Site-3	Harrawala	Wheat, Mustard, Rice, Loki and Pumpkin
4.	Site-4	Nakraunda	Wheat, Rice, Mustard and Loki

Table 2: Taxonomic composition of coccinellids in four sites during Jan. to Dec. 2021

SN	Coccinellidae species	Sites			
(A) Subfamily: CHILOCORINAE	(I) Tribe Chilicorini	S-1	S-2	S-3	S-4
1.	<i>Brumoides suturalis</i> (Fabricius)	+	-	+	-
(B) Subfamily: COCCINELLINAE	(II) Tribe Coccinellini				
2.	<i>Coccinella septumpunctata</i> (Linn.)	+	+	+	+
3.	<i>Coccinella transversalis</i> (Fabricius)	+	+	+	+
4.	<i>Cheilomenes sexmaculata</i> (Fabricius)	+	+	+	+
5.	<i>Hippodamia variegata</i> (Goeze)	-	+	+	+
6.	<i>Harmonia dimidiata</i> (Fabricius)	-	-	-	+
7.	<i>Oenopia sauzeti</i> (Mulsant)	+	-	+	-
(C) Subfamily: EPILACHNINAE	(III) Tribe Epilachnini				
8.	<i>Henosepilachna vigintioctopunctata</i> (Li)	-	+	+	+
	Total	05	05	07	06

+ Species Present, - Species Absent

Table 3: Abundance of coccinellid beetles in four sites during Jan. 2021 to Dec. 2021

SN	Coccinellidae species	Sites				Total Ni
(A) Subfamily: CHILOCORINAE	(I) Tribe Chilicorini	S-1	S-2	S-3	S-4	Total Ni
1.	<i>Brumoides suturalis</i> (Fabricius)	24	-	23	-	47
(B) Subfamily: COCCINELLINAE	(II) Tribe Coccinellini					
2.	<i>Coccinella septumpunctata</i> (Linn.)	51	39	68	53	211
3.	<i>Coccinella transversalis</i> (Fabricius)	37	44	52	39	172
4.	<i>Cheilomenes sexmaculata</i> (Fabricius)	29	23	40	57	149
5.	<i>Hippodamia variegata</i> (Goeze)	-	19	27	23	69
6.	<i>Harmonia dimidiata</i> (Fabricius)	-	-	-	12	12
7.	<i>Oenopia sauzeti</i> (Mulsant)	17	-	14	-	31
(C) Subfamily: EPILACHNINAE	(III) Tribe Epilachnini					
8.	<i>Henosepilachna vigintioctopunctata</i> (Li)	-	17	23	21	61
	Total	158	142	247	205	752

Table 4: Species richness, population density and %age of coccinellids during Jan. to Dec. 2021

Parameters	Site-1	Site-2	Site-3	Site-4
Species Richness	05	05	07	06
Density/hectare	53	47	82	68
Percentage	21	19	33	27

these eight species, seven were predatory and one was phytophagous. The only phytophagous species was *H. vigintioctopunctata* (Li). The only phytophagous species was *H. vigintioctopunctata* (Li) (Table-2). From this study, it was observed that *Coccinella septumpunctata*, *C. transversalis* and *Cheilomenes sexmaculata* were the dominant species as they were recorded in all four sites. Two

species viz., *Henosepilachna vigintioctopunctata* (Li) and *Hippodamia variegata* (Goeze) were moderately common and were present in only three sites. Two species viz. *Brumoides suturalis* (Fabricius) and *Oenopia sauzeti* (Mulsant), were less abundant and were present in only three sites. One Species *Harmonia dimidiata* were less abundant and were present only in one site. Highest

number of coccinellids species were collected from site-3 (7 species), then followed by site-4 (6 species), site-1 and site-2 (5 species each).

(C) Abundance of Ladybird beetles

A total of 752 individuals of ladybird beetles were collected at four sites having agricultural ecosystem. Maximum numbers of ladybird beetles (247) were collected from site-3 followed by site-4 (205), site-1 (158) and site-2 (142). From above study, it was observed that *Coccinella septempunctata* (Linn.) was the most abundant species (211) followed by *C. transversalis* (Fab.) (172), and *Cheilomenes sexmaculata* (Fab.) (149) in terms of no. of individuals and were recorded from all four sites. *Hippodamia variegata* (Goeze) (69) and *Henosepilachna vigintioctopunctata* (Li) (61) were moderately abundant species in terms of no. of individuals and were present only in three sites. *Brumoides suturalis* (Fabricius) (47) and *Oenopia sauzeti* (Mul.) (31) were less abundant species in terms of no. of individuals and were present only in two sites. *Harmonia dimidiata* (Fab.) (12) were less abundant species in terms of no. of individuals and were present only in one site. From above study, it was also observed that three species were common and recorded from all four sites. Two species were moderately common and were present only in three sites. Two species were less common and were present only in two sites. One species were less abundant and were present only in one site (Table-3).

(D) Population Density

Highest number of coccinellids species were collected from site-3 (7 species), followed by site-4 (6 species), site-1 and site-2 (5 species each). Density of Ladybird beetles species was 53/ha in site-I, 47/ha in site-II, 82/ha in site-III and 68 in site-IV (Table-4). In site-I, *C. septempunctata* had the highest density (17/ha), followed by *C. transversalis* (12.33/ha) and *C. sexmaculata* (9.66/ha). In site-II, *C. transversalis* had the highest density (14.66/ha) followed by *C. septempunctata* (13/ha) and *C. sexmaculata* (7.66/ha). In site-III, *C. septempunctata* had the highest density (22.66/ha) followed by *C. transversalis* (17.33/ha) and *C. sexmaculata* (13.33/ha). In site-IV, *C. sexmaculata* had the maximum density (19/ha) followed by *C. septempunctata* (17.66/ha) and *C. transversalis* (13/ha). Maximum percentage sharing (33 %) of coccinellids fauna was shared by site-3, then

followed by site-4 (27 %), site-1 (21 %) and site-2 (19%) (Table-4). Pajni and Singh (1982) reported 30 species of ladybird beetles from different study sites of Chandigarh. Pajni and Verma (1985) discussed male genitalia of 25 coccinellids from Chandigarh region. Singh and Singh (1990) have recorded four new species of coccinellids viz., *Epilachna shilliensis*, *E. convexata*, *E. septemocellata* and *E. crecentomaculata* from Shilli, Himachal Pradesh. Omkar and Bind (1996) have recorded 05 species viz., *B. suturalis* (Fabr.), *I. cincta* (Fabr.), *M. discolor* (Fabr.), *M. vincta* (Gorham) and *P. bisoctonata* (Muls.) from Lucknow (U.P.), India. Joshi and Sharma (2008) have reported 31 species of coccinellids from Haridwar district. Joshi *et al.*, (2010) reported 21 species of Ladybird beetles from different study sites of district Pauri-Garhwal (U.K.), India. Sharma and Joshi (2010) reported 25 species of ladybird beetles from different study sites of district Dehradun.

Conclusion

The occurrence of 08 species of ladybird beetles in four different study sites recorded in only one-year study indicate that Doiwala region have good community structure of coccinellids. The chances of disturbances in environment of agriculture ecosystem are high, as due to heavy infestations of pests, the economic cash crops are a target of a lot of toxic chemicals and insecticides that also affect the non-target insect fauna of that ecosystem. Any change in agricultural environment may lead the disappearance or repulsion or migration disappearance of coccinellids. As a result, the community size of coccinellid beetles may be decreased. Further observation is required in those regions that were not studied to fully explore the coccinellids fauna. Thus, the present study points out that the distribution, species richness and abundance of insect species may depend on plant community structure, availability of prey species and climate of the study area. As coccinellids play a principal role in suppression of crop pests, hence, this study may be useful in understanding the prey-predator interactions.

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Conflict of interest

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